Joint Advanced Distributed Simulation Joint Test Force
11104 Menaul Boulevard NE
Albuquerque, New Mexico 87112

The JADS Analysis Toolbox User's Manual

(June 24, 1999 Release)

A Tool for Analysis of Distributed Simulations

by: Dean Gonzalez, SAIC
Jerry Black, SAIC

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JOINT ADVANCED DISTRIBUTED SIMULATION
JADS
JOINT TEST FORCE

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Introduction

The Joint Advanced Distributed Simulation (JADS) Joint Test Force (JTF) is investigating the utility of advanced distributed simulation (ADS) technology for test and evaluation (T&E). JADS is executing three tests representative of portions of the T&E testing spectrum to obtain data for its evaluation. These tests linked live test assets, constructive models, and virtual simulations at multiple test facilities and test ranges across the country.

Science Applications International Corporation (SAIC) developed a software product called the **JADS Analysis Toolbox** that has been very helpful in the evaluation of the JADS tests. The toolbox comprises a set of C++ routines integrated into a single user interface. Users can view tabulations and plots of protocol data units (PDU) data in near real time, can replay or get selected data in a text-readable format from the JADS logfile(s) post test, and can obtain predefined plots and tabulations of PDU statistics for post-test analyses.

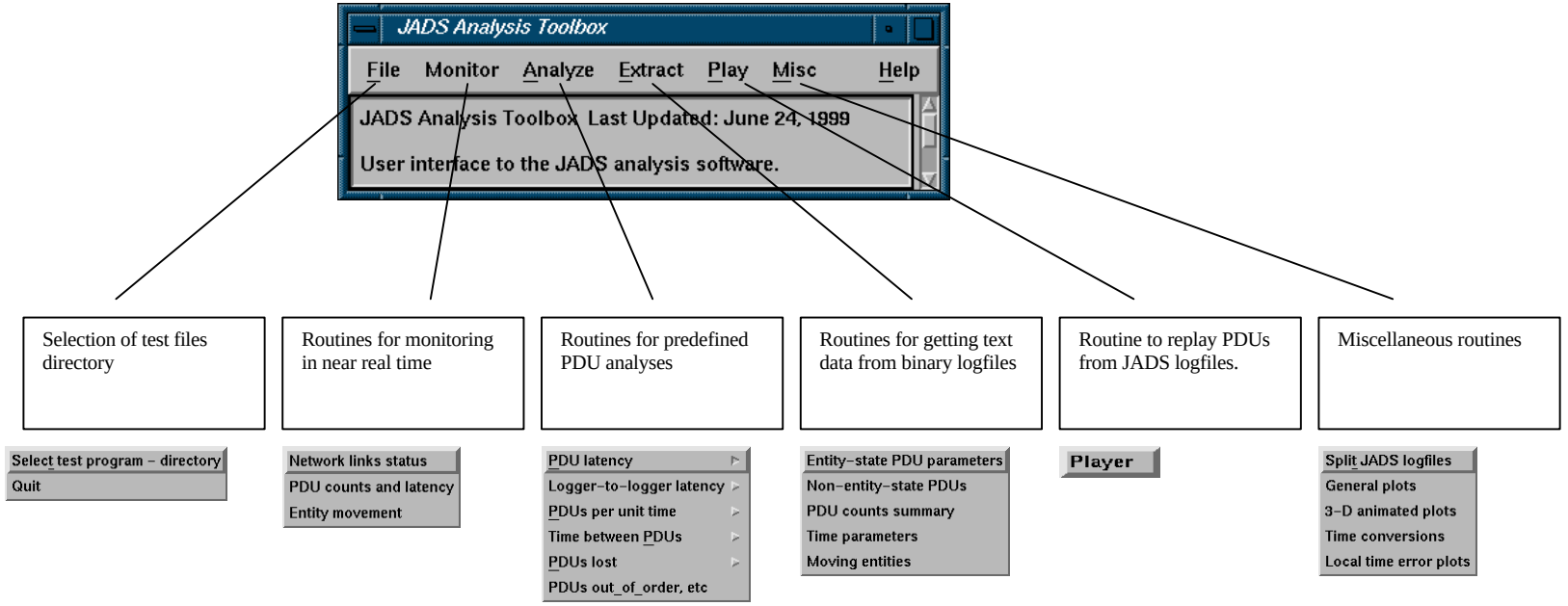
The toolbox's main window allows users to select tools appropriate to their needs.

As shown in the diagram, tools have been sorted into 5 major categories:

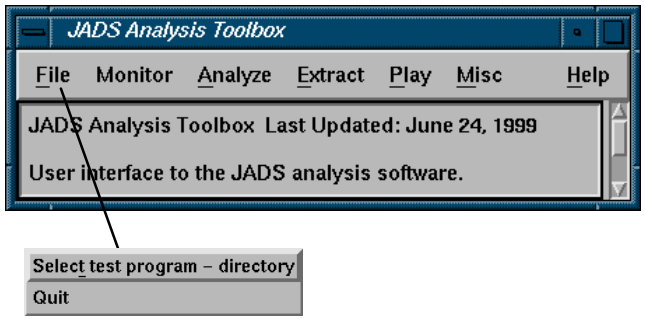
- Monitor tools — provide the user with analysis data in near real time
- Analyze tools — provide the user with predefined analyses and outputs
- Extract tools — provide the user with text data from the binary logfiles
- Play tools — provide the user with the ability to replay PDUs from a logfile
- Miscellaneous tools — provide the user with the ability to split JADS logfiles, etc.

Each of these tools will be described in more detail.

Introduction



1. File



The **File** menu allows the user to select the test program. A dialog shows the currently available test programs which the user may select from. The test program name is used as the name of the directory where toolbox routines will look for logfiles and where output data will be placed. Logfiles must be stored and named as follows:

Logfiles must be stored in the directory $LOGS_DIR/<test_program>/<date>/logfile.log where

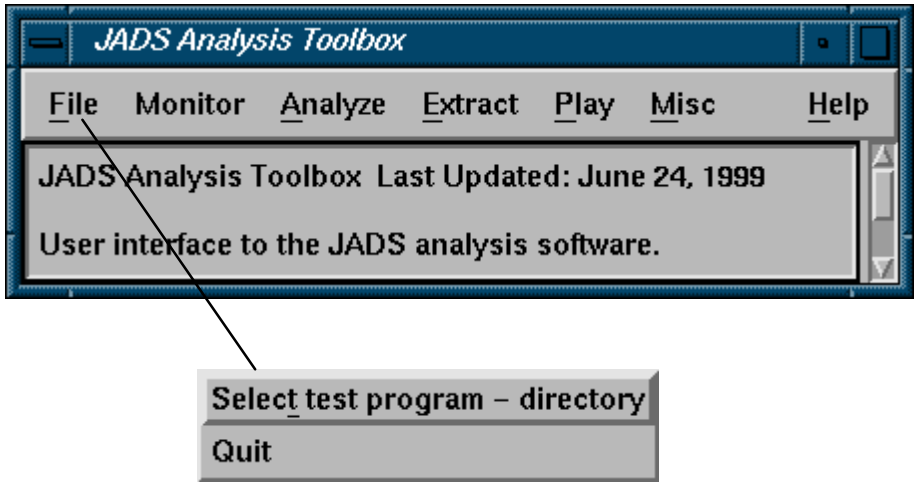
$LOGS_DIR is the UNIX™ environment variable that defines the directory where test data logs and results are stored.
<test_program> is the directory (under the $LOGS_DIR) for a given test program.
<date> is the directory (under <test_program>) for data from the test date. It is a 6-digit (mmddyy) string.
logfile is the name of the logfile. The appendix, '.log' designates a logfile created using the JADS logger.

Logfiles must use the naming convention mmddyy_testxx_locn.log where

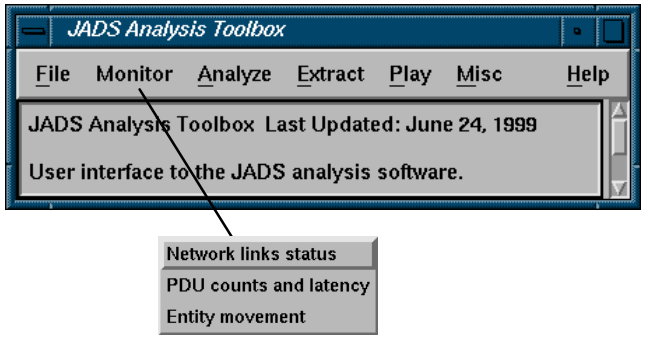
mmddyy is the date of the mission (6 digits)
test can be any set of characters such as 'test', 'trial', 'exercise', etc.
xx is two (or more) digits that specify the test number within the mission
locn is an alphanumeric string designating the location (node) of the logger

Output files created by the toolbox routines are stored in the directory $LOGS_DIR/<test_program>/<date>/results.

1. File


JADS Analysis Toolbox
File
Monitor
Analyze
Extract
Play
Misc
Help
JADS Analysis Toolbox Last Updated: June 24, 1999
User interface to the JADS analysis software.
Select test program – directory
Quit

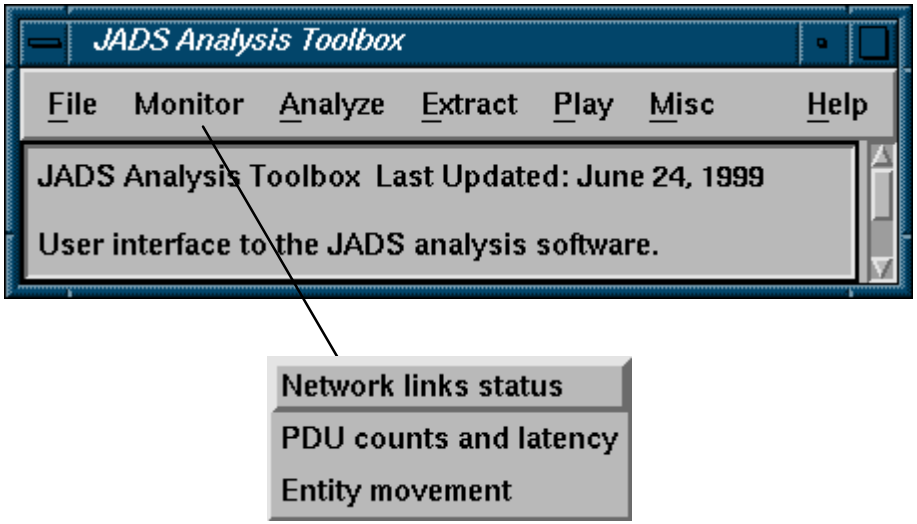
2. Monitor



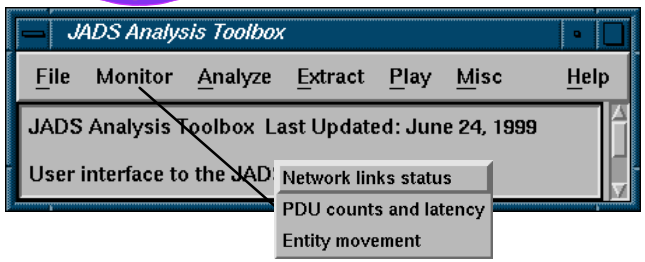
The toolbox **Monitor** menu has three menu items: **Network links status**, **PDU counts and latency,** and **Entity movement**.

These routines allow the analyst to view various PDU data in near real time in tabular and/or plot form. The routines are described on pages 10 - 15.

2. Monitor


JADS Analysis Toolbox
File
Monitor
Analyze
Extract
Play
Misc
Help
JADS Analysis Toolbox Last Updated: June 24, 1999
User interface to the JADS analysis software.
Network links status
PDU counts and latency
Entity movement

2.1 Network Links Status



The **Monitor - Network links status** menu item calls up a dialog that allows the user to enter parameters before calling link_status. This dialog allows the user to browse for the hosts_file (a text file that contains the names of hosts on the network which will be pinged by this program) and to define the following parameters which are used by the ping command in link_status:

time_between_packets	integer number of seconds
packet_size	integer number of bytes
number_packets per ping	integer number

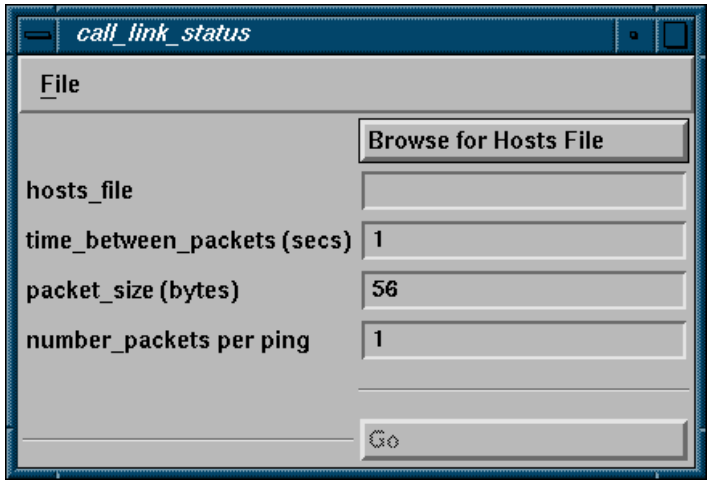
The link_status program will show a stoplight display. The stoplight display will show either red, yellow, or green as a status for each of the hosts in the hosts file.

If ping time is greater than 500 msecs or packet loss is greater than 0,	the ping is considered BAD
otherwise	the ping is considered GOOD

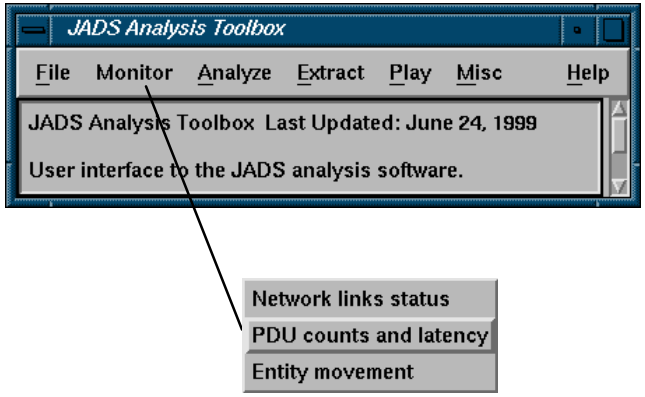
If the current ping is GOOD,	the status is displayed as GREEN
If the current ping is BAD, but the previous ping was GOOD,	the status is displayed as YELLOW
If the current ping is BAD, and previous ping was also BAD,	the status is displayed as RED

Output of the program is written to $TMP_DIR/link_status.mmddyy, where mmddyy are six digits representing the current date, and $TMP_DIR is an environment variable defining where temporary files may be written.

2.1 Network Links Status



2.2 PDU Counts and Latency



The **Monitor - PDU counts and latency** menu selection brings up the **PDU Monitor** main window. Its menus, dialogs, and outputs are shown on the facing page.

The **File** menu allows the user to **Change Port** from which data are being received.

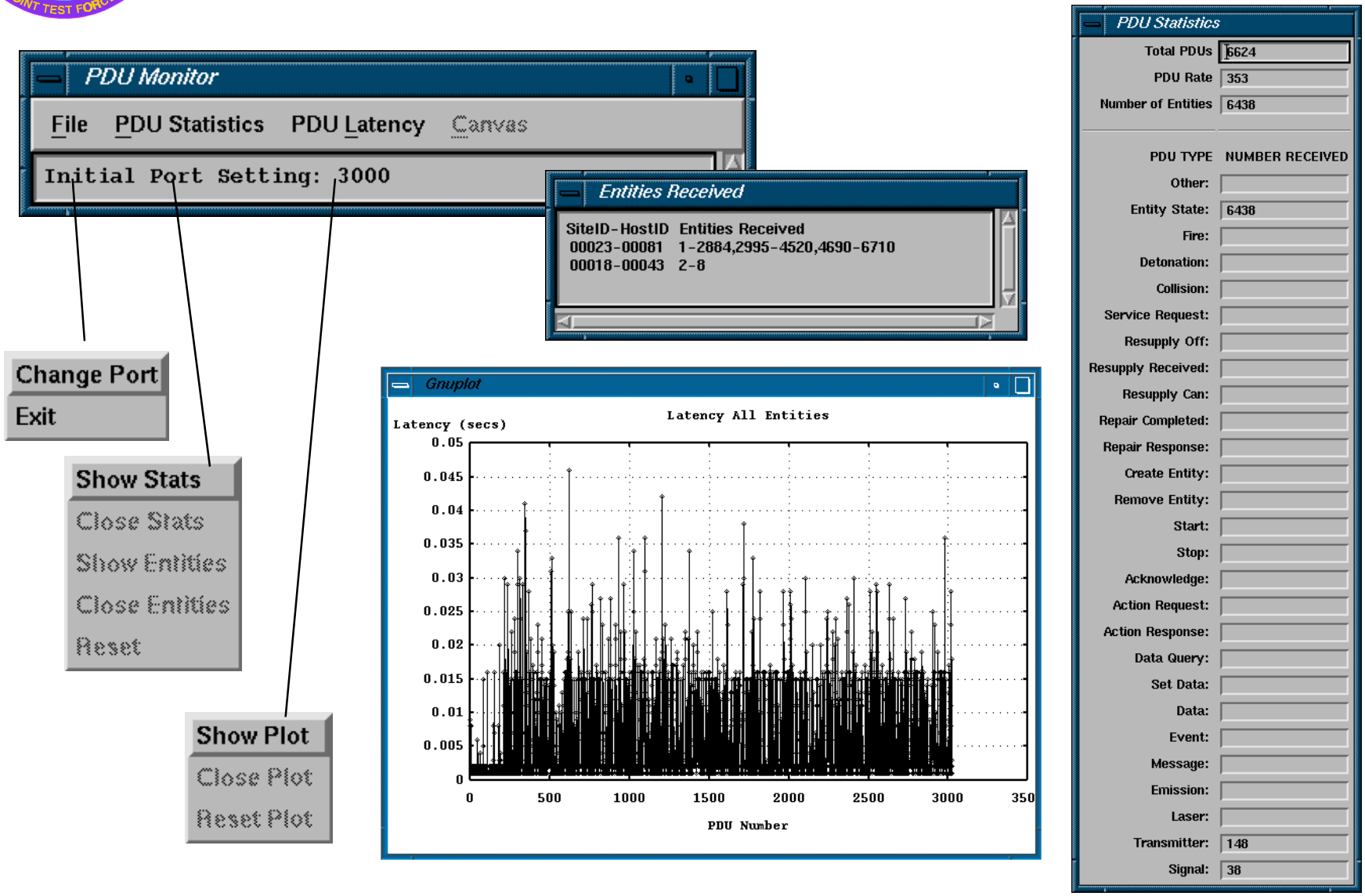
The **PDU Statistics** menu items are the following:

Show Stats	brings up the **PDU Statistics** window.
Close Stats	closes the **PDU Statistics** window.
Show Entities	brings up the **Entities Received** window.
Close Entities	closes the **Entities Received** window.
Reset	resets the statistics shown in the two windows.

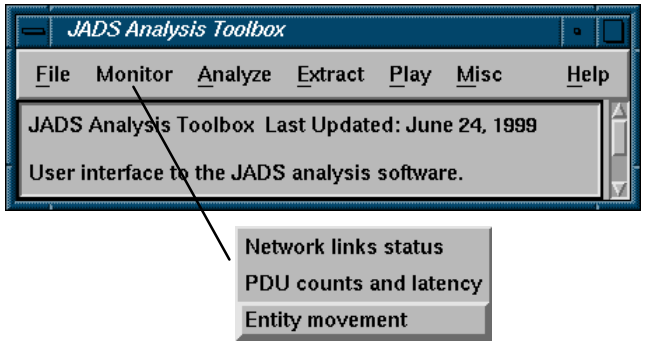
The **PDU Latency** menu items are the following:

Show Plot	displays a plot of PDU latency (received time - PDU time) versus PDU received
Close Plot	closes the plot
Reset Plot	resets the plot

2.2 PDU Counts and Latency



2.3 Entity Movement



The **Monitor - Entity movement** brings up the **realtime_3d** main window that that provides a 3-D display of position for up to 3 entities. Its menus, dialogs, and outputs are shown on the facing page.

realtime_3d has the following menu items:

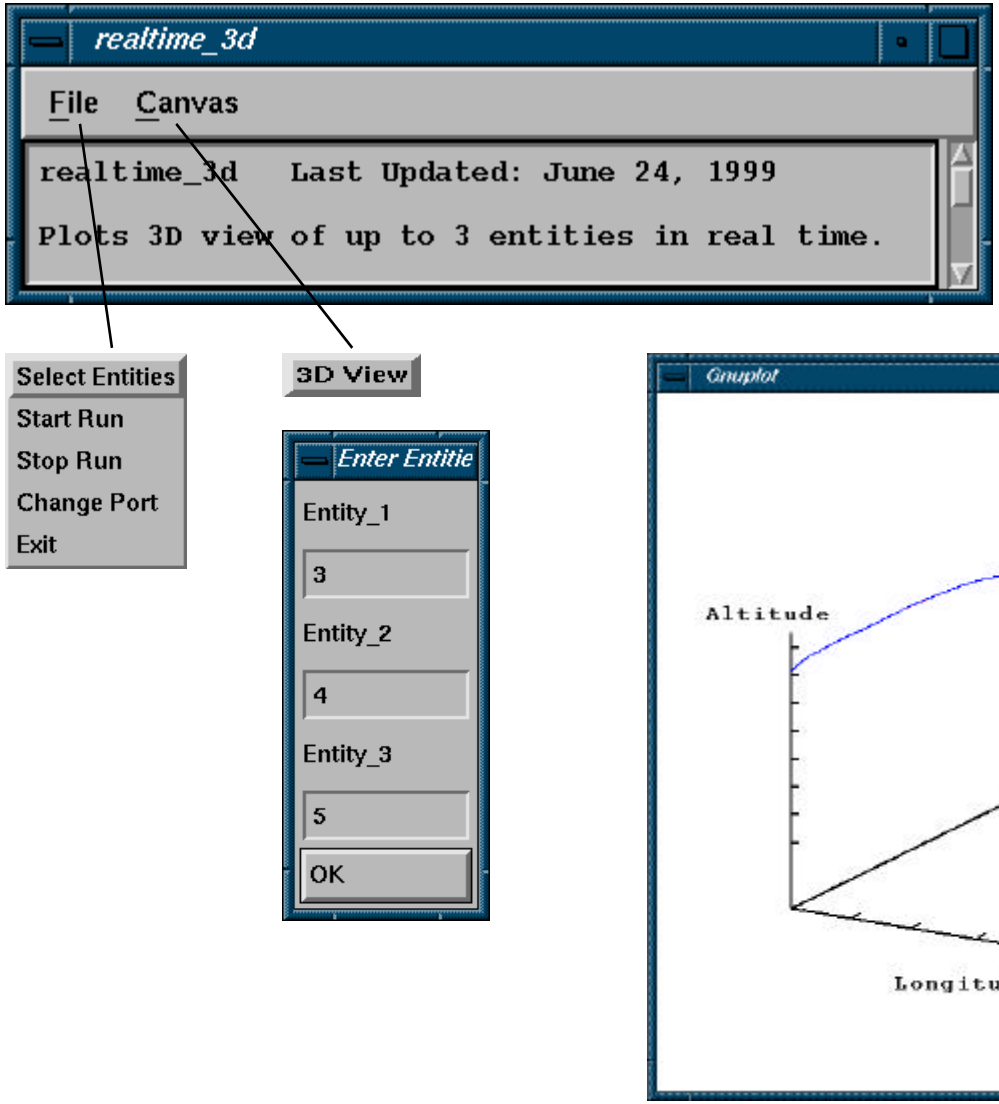
File menu has the following menu items

Select Entities	lets user select up to 3 entities
Start Run	starts receiving PDUs and plotting
Stop Run	stops receiving PDUs and plotting
Change Port	changes the port data are received from
Exit	terminates the program

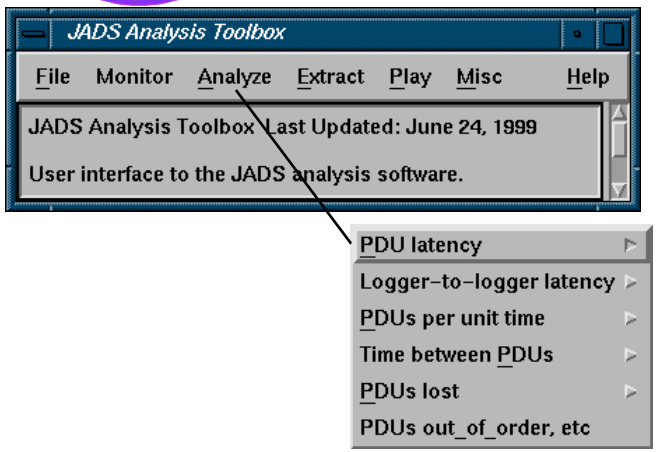
The **Canvas** Menu has the following menu item

3D View	provides arrows that control 3D viewing angles

2.3 Entity Movement



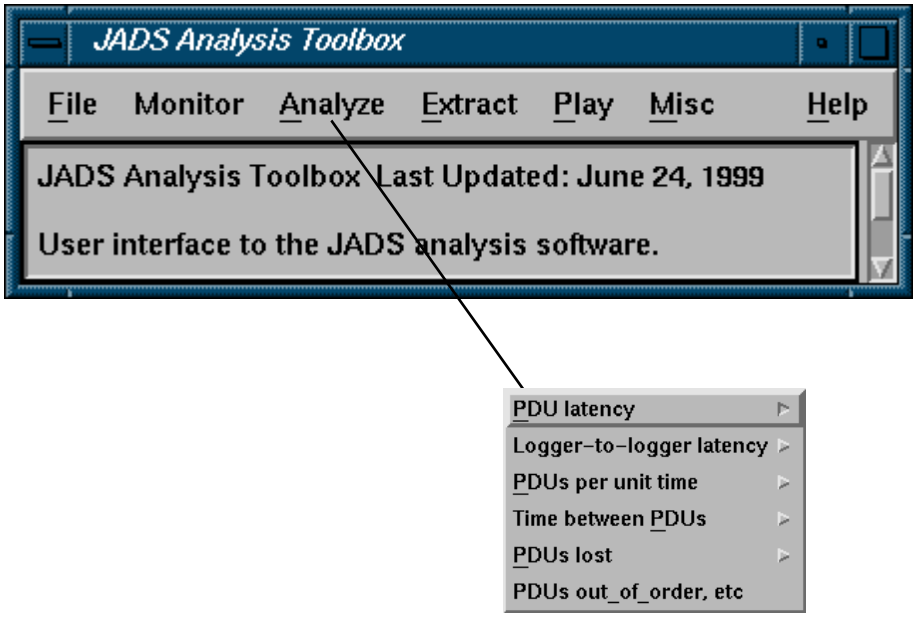
3. Analyze



The **Analyze** menu can be used to call up routines that have predefined analysis functions.

Each of these routine's main window, dialogs and sample outputs are shown on pages 18 - 29.

3. Analyze


JADS Analysis Toolbox
File
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Misc
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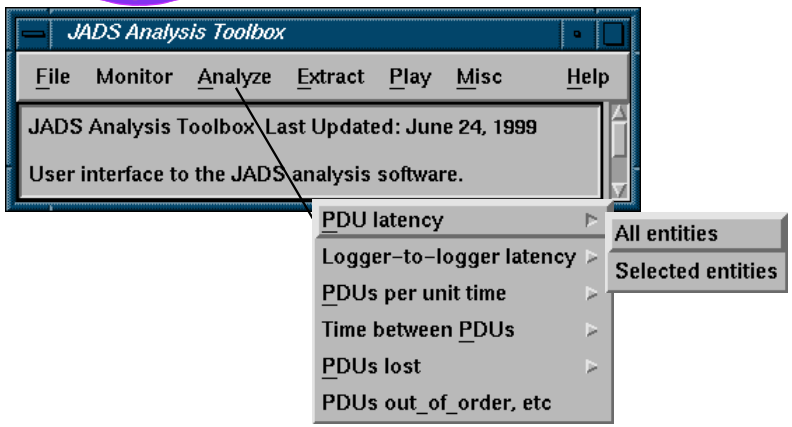
JADS Analysis Toolbox Last Updated: June 24, 1999
User interface to the JADS analysis software.
PDU latency
Logger-to-logger latency
PDUs per unit time
Time between PDUs
PDUs lost
PDUs out_of_order, etc

3.1 PDU Latency



The **Analyze - PDU latency** (**All entities** or **Selected entities**) menu items provide plots of PDU latency (log time - PDU time) for all or selected entities. Data are obtained from .gnu files.

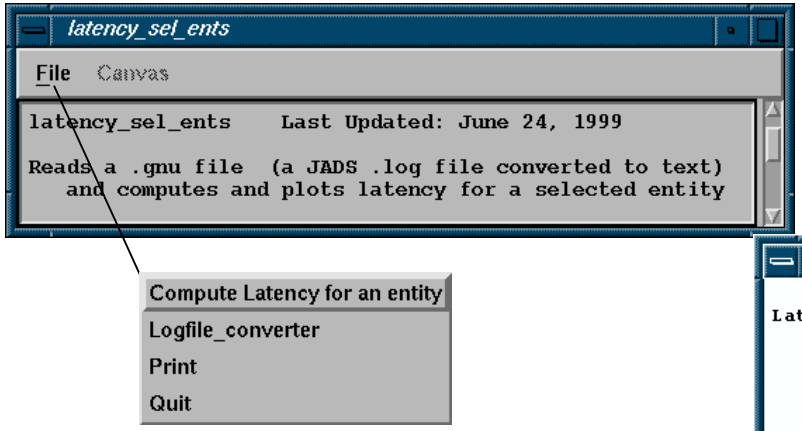
Gnu files are JADS logfiles that have been converted to text and that contain

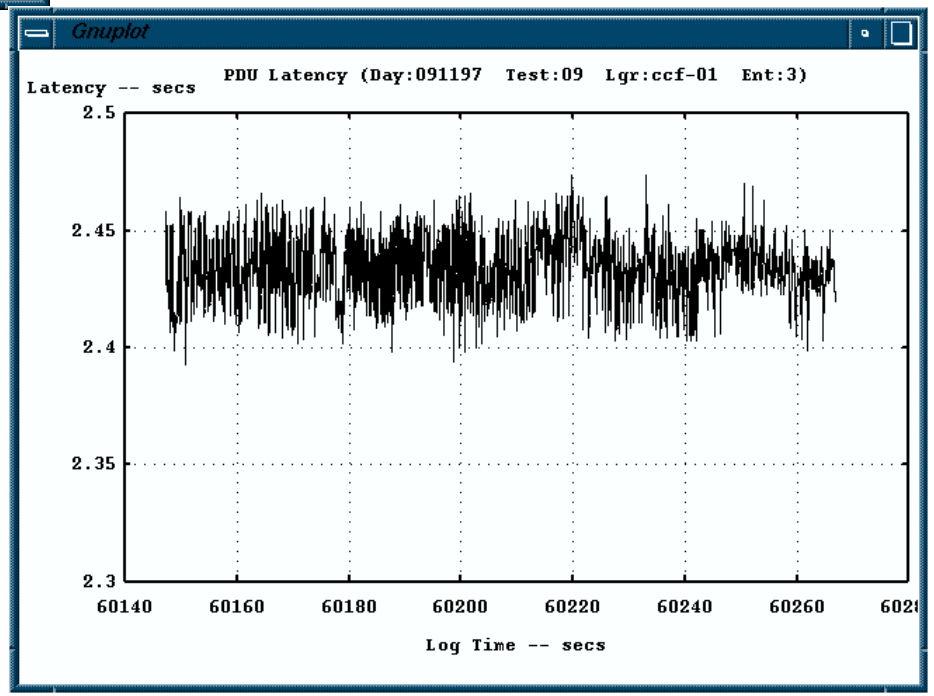
entity id		latitude	degrees
log time	msecs	longitude	degrees
PDU time	msecs	altitude	feet

The **Logfile_converter** that creates the .gnu files adds the hour from the first log time to the PDU time and keeps track of hour rollovers so that the PDU time has a 24 hour basis just as the log time. If .gnu files are not available for the desired mission, test, and logger, use **Logfile_converter** from the file menu to create them.

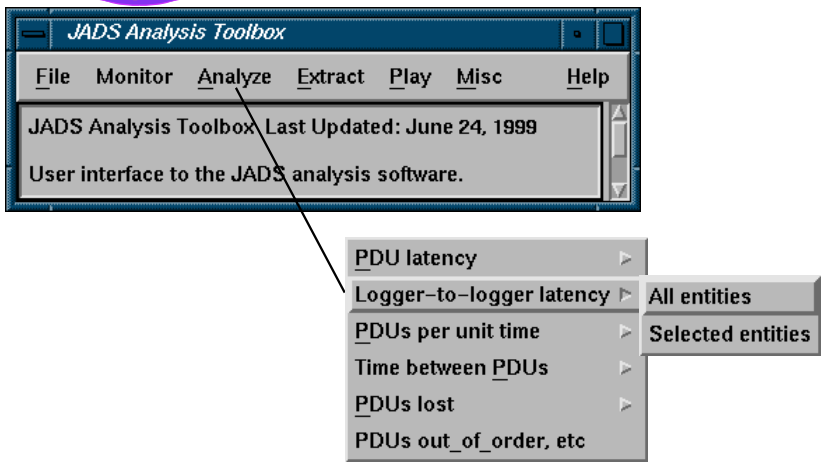
The **canvas** menu allows the user to format the plot. Plots may be printed using the file menu. The figure shows PDU latency for a selected entity.

3.1 PDU Latency





3.2 Logger -to-Logger Latency



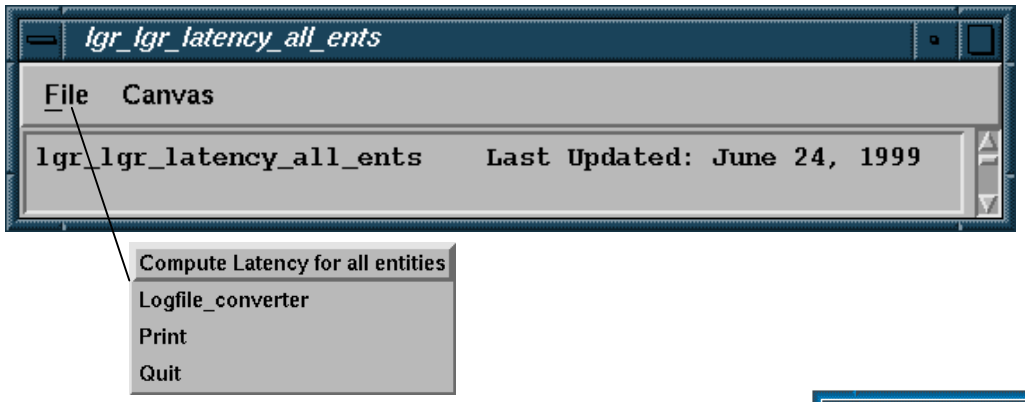
The **Analyze - Logger-to-logger latency** menu item allows the user to compute and plot the latency of PDUs as they travel from one logger to another (for **All entities** or **Selected entites**). Data are obtained from .gnu files.

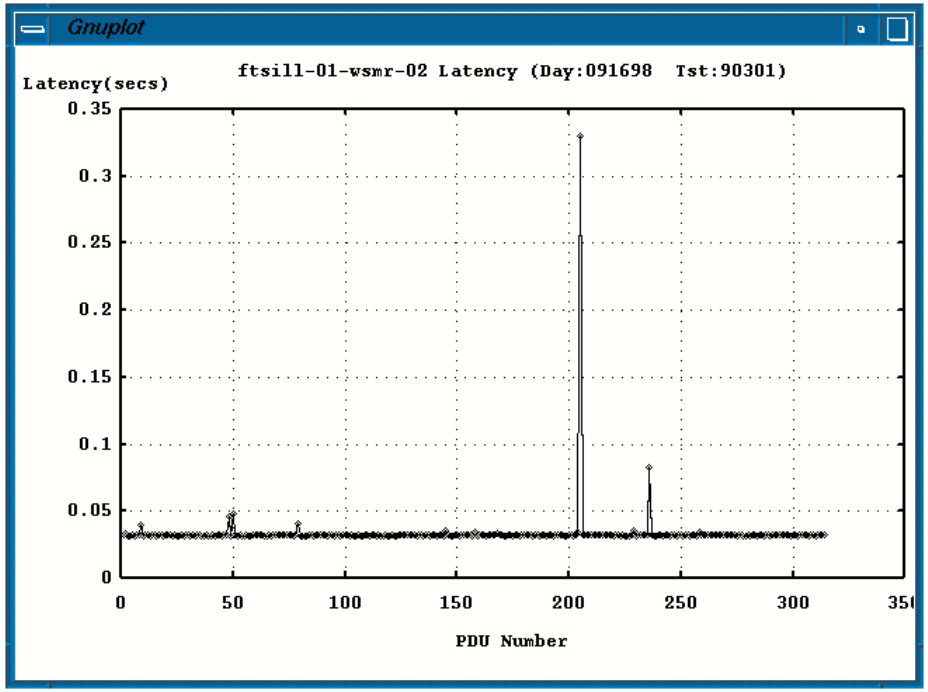
Latency is computed by finding the same PDU at the two loggers and subtracting the base logger log time from the other logger log time.

If .gnu files are not available for the desired mission, test, and logger, use **Logfile_converter** from the file menu to create them.

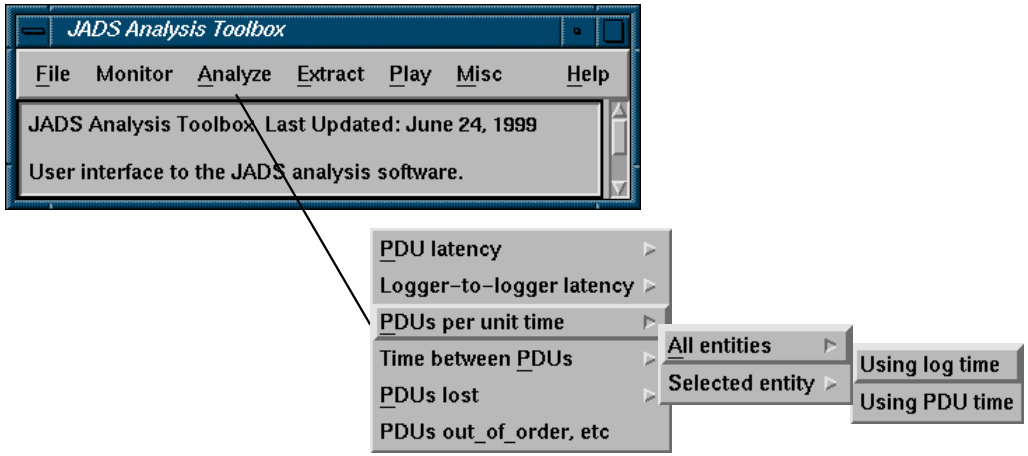
The **canvas** menu allows the user to format the plot. Plots may be printed using the file menu.

3.2 Logger -to-Logger Latency





3.3 PDUs Per Unit Time



The **Analyze - PDUs per unit time** menu item allows the user to compute and plot the number of PDUs per second (**Using log time** or **Using PDU time**) (for **All entities** or **Selected entities**).

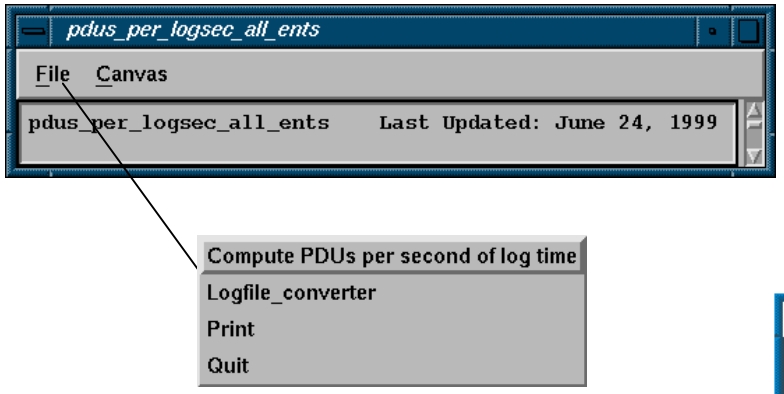
Data are obtained from .gnu files.

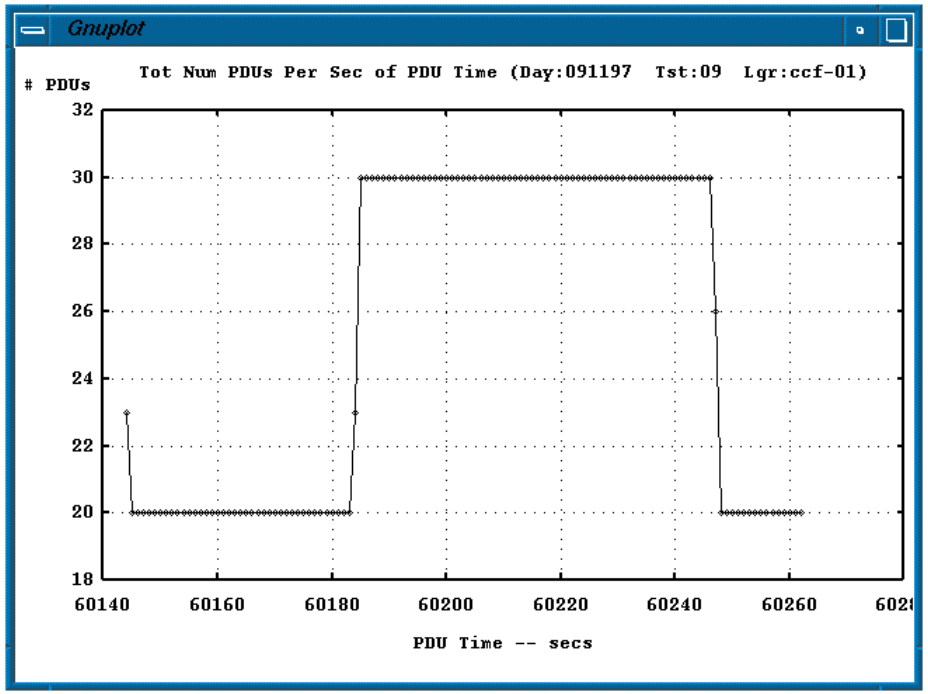
If .gnu files are not available for the desired mission, test, and logger, use **Logfile_converter** from the file menu to create them.

The **Canvas** menu allows the user to format the plot.

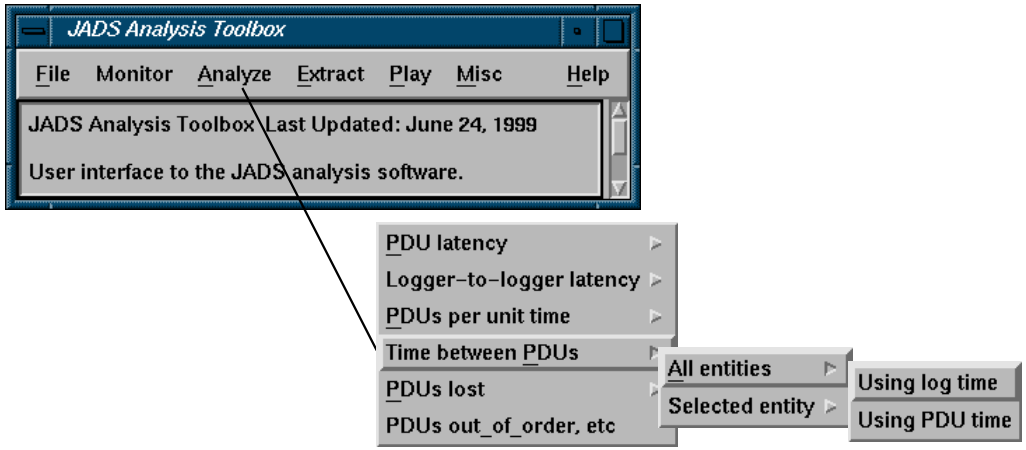
Plots may be printed using the file menu.

3.3 PDUs Per Unit Time





3.4 Time Between PDUs



The **Analyze - Time between PDUs** menu item allows the user to compute and plot the time (**Using log time** or **Using PDU time**) between successive PDUs (for **All entities** or **Selected entities**).

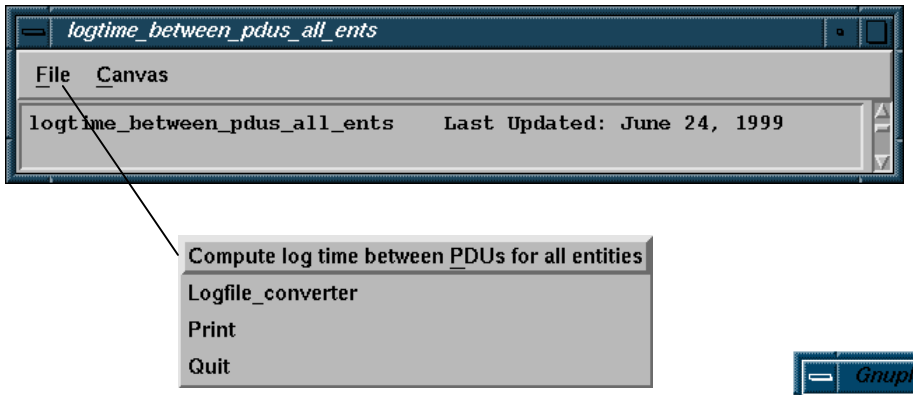
Data are obtained from .gnu files.

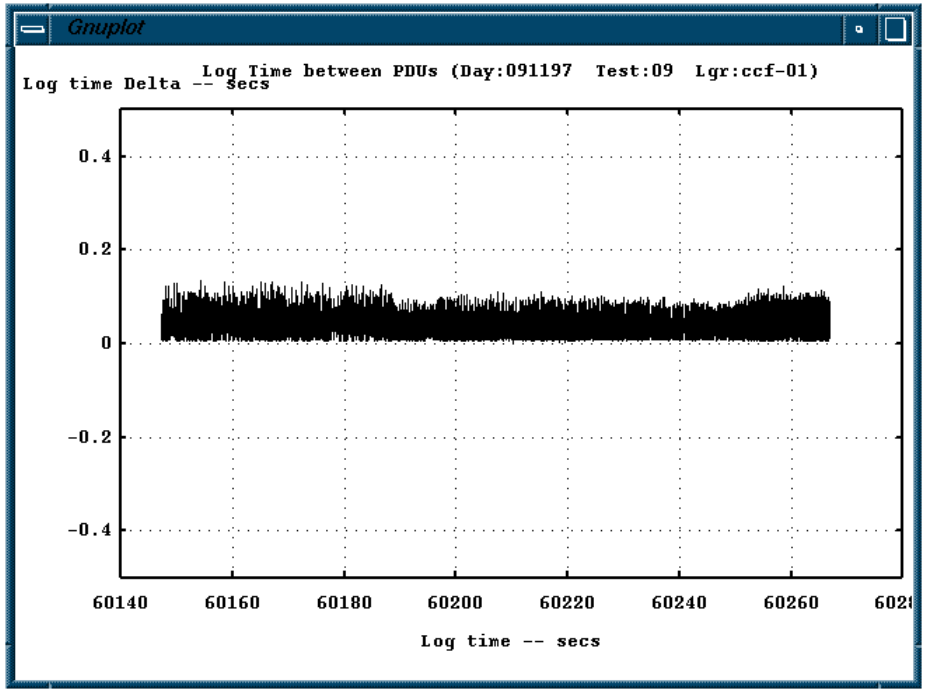
If .gnu files are not available for the desired mission, test, and logger, use **Logfile_converter** from the file menu to create them.

The **Canvas** menu allows the user to format the plot.

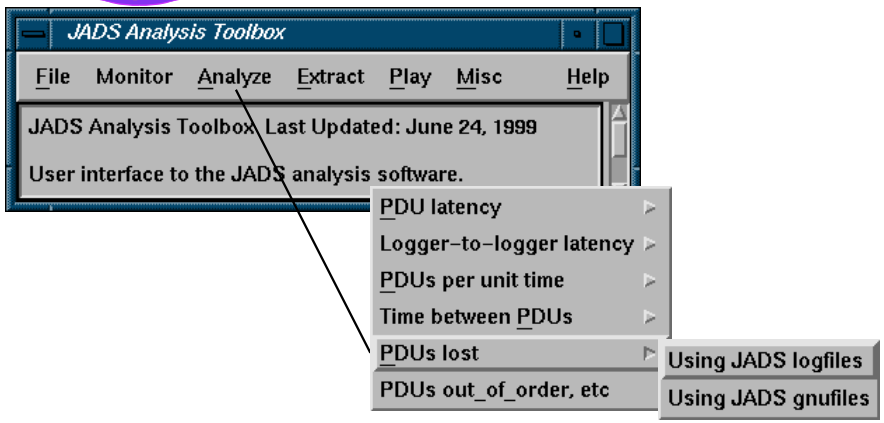
Plots may be printed using the file menu.

3.4 Time Between PDUs





3.5 PDUs Lost

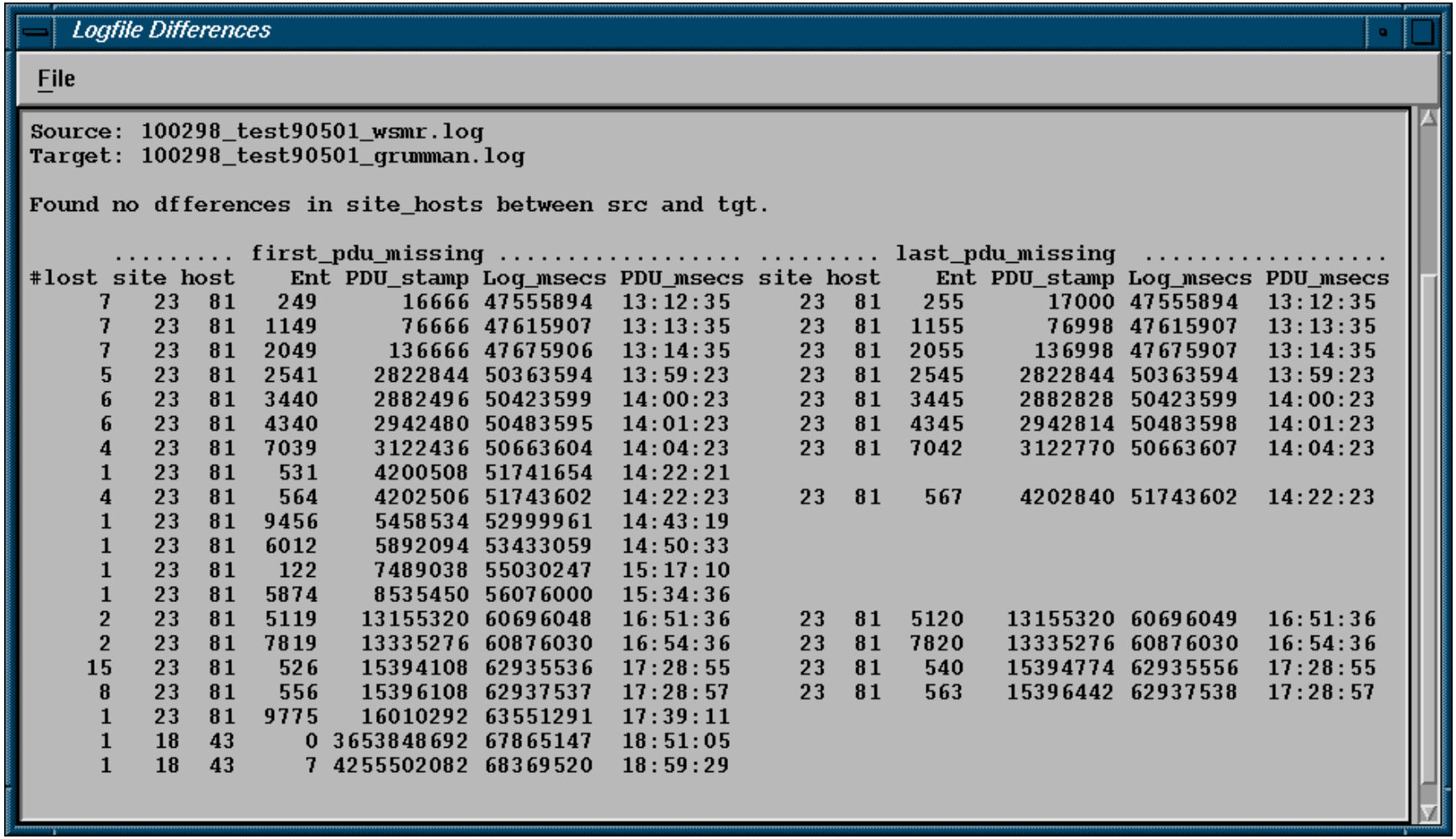


The **Analyze - PDUs lost** menu item allows the user to compare PDUs recorded at a source logfile to PDUs recorded at a target logfile. PDUs recorded at the source but not at the target are reported as lost PDUs.

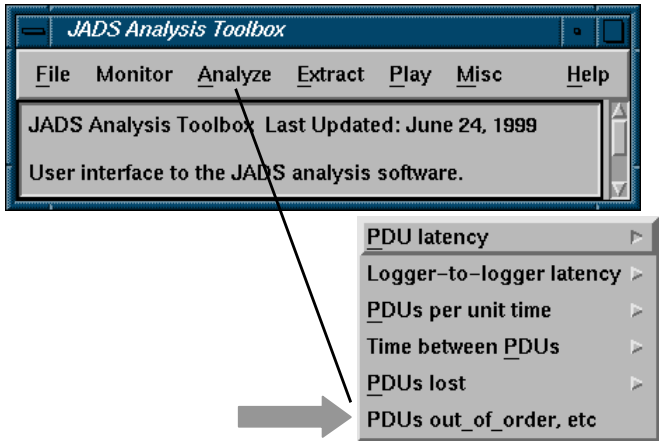
The computation may be performed **Using JADS logfiles** or **Using JADS gnufiles**.

Selected data from the first and last missing PDU are printed for missing PDUs blocks.

3.5 PDUs Lost


Logfile Differences
File
Source: 100298_test90501_wsmr.log
Target: 100298_test90501_grumman.log
Found no dfferences in site_hosts between src and tgt.
first_pdu_missing
last_pdu_missing
#lost site host Ent PDU_stamp Log_msecs PDU_msecs site host Ent PDU_stamp Log_msecs PDU_msecs
7 23 81 249 16666 47555894 13:12:35 23 81 255 17000 47555894 13:12:35
7 23 81 1149 76666 47615907 13:13:35 23 81 1155 76998 47615907 13:13:35
7 23 81 2049 136666 47675906 13:14:35 23 81 2055 136998 47675907 13:14:35
5 23 81 2541 2822844 50363594 13:59:23 23 81 2545 2822844 50363594 13:59:23
6 23 81 3440 2882496 50423599 14:00:23 23 81 3445 2882828 50423599 14:00:23
6 23 81 4340 2942480 50483595 14:01:23 23 81 4345 2942814 50483598 14:01:23
4 23 81 7039 3122436 50663604 14:04:23 23 81 7042 3122770 50663607 14:04:23
1 23 81 531 4200508 51741654 14:22:21
4 23 81 564 4202506 51743602 14:22:23 23 81 567 4202840 51743602 14:22:23
1 23 81 9456 5458534 52999961 14:43:19
1 23 81 6012 5892094 53433059 14:50:33
1 23 81 122 7489038 55030247 15:17:10
1 23 81 5874 8535450 56076000 15:34:36
2 23 81 5119 13155320 60696048 16:51:36 23 81 5120 13155320 60696049 16:51:36
2 23 81 7819 13335276 60876030 16:54:36 23 81 7820 13335276 60876030 16:54:36
15 23 81 526 15394108 62935536 17:28:55 23 81 540 15394774 62935556 17:28:55
8 23 81 556 15396108 62937537 17:28:57 23 81 563 15396442 62937538 17:28:57
1 23 81 9775 16010292 63551291 17:39:11
1 18 43 0 3653848692 67865147 18:51:05
1 18 43 7 4255502082 68369520 18:59:29

3.6 PDUs Out of Order, etc.



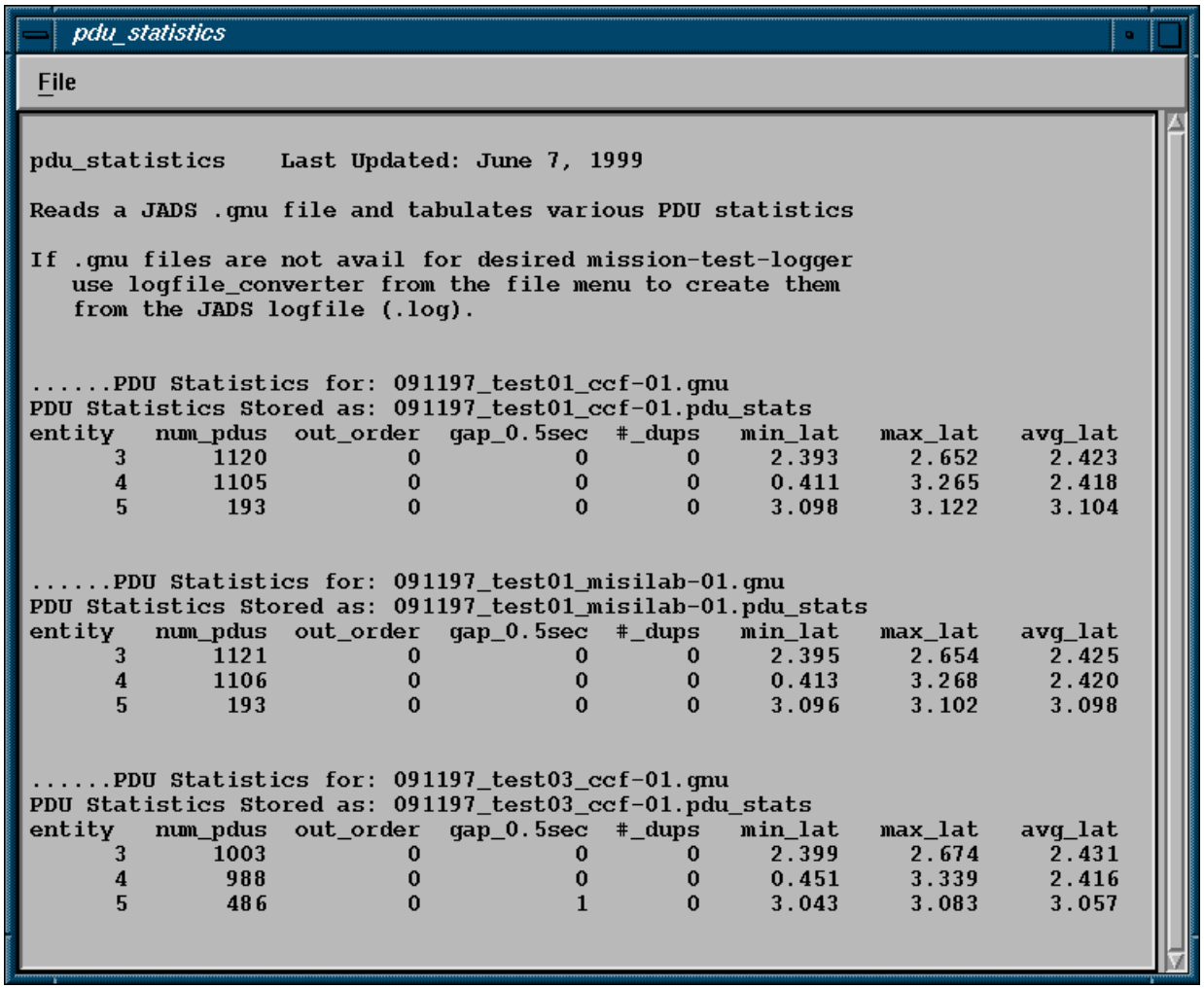
The **Analyze - PDUs out_of_order, etc** menu item brings up the **PDU_statistics** main window.

The **PDU_statistics** main window allows the user to select .gnu files for which statistics are desired. As each file is selected, the program prints the following for each entity found in the file:

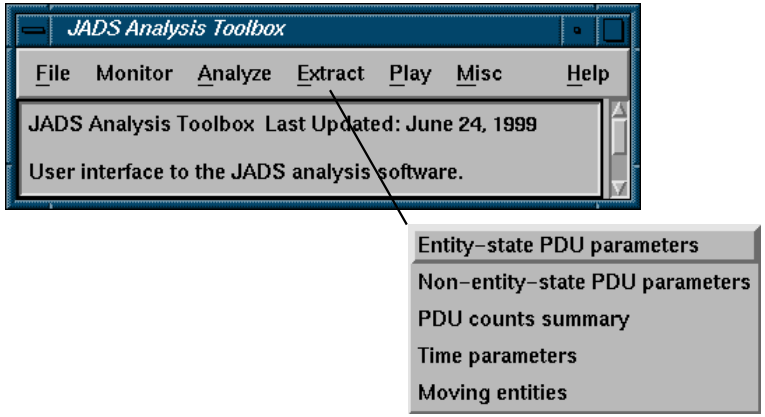
number of PDUs
the number of PDUs out of order
the number of PDU gaps (log time between PDUs greater than 0.5 seconds)
the number of duplicate PDUs
the minimum, maximum, and average latency (logged time minus PDU time)

These are very useful data especially in the early days of testing an ADS architecture, as faulty architectural components can easily cause PDUs to be received out of order, duplicate PDUs, or excessive latencies.

3.6 PDUs Out of Order, etc.

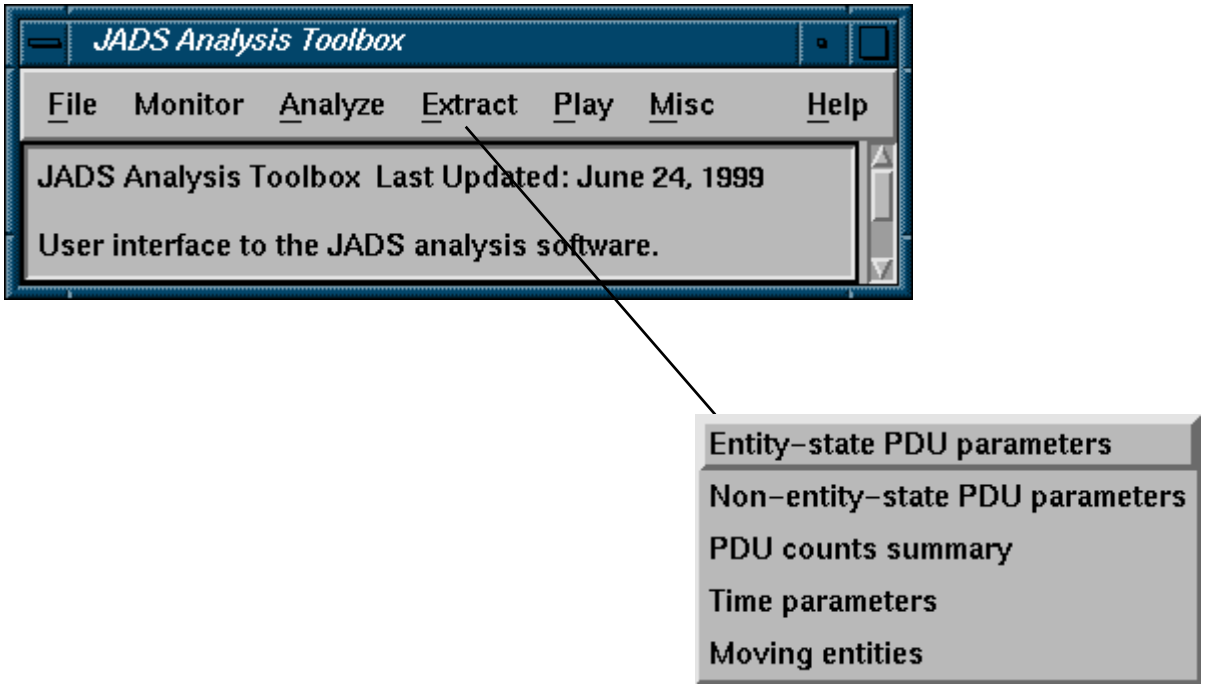


4. Extract

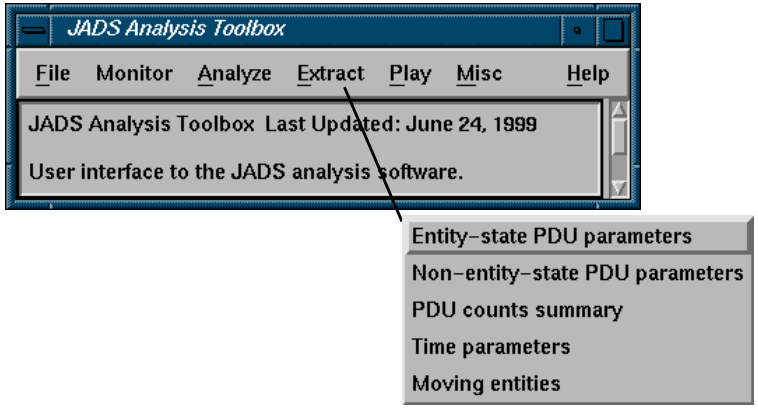


The **Extract** menu allows the user to extract selected data and/or statistics from the JADS logger binary files as text data. Extracted data are typically saved as a file. The various extraction routines are explained on pages 32-41.

4. Extract


JADS Analysis Toolbox
File
Monitor
Analyze
Extract
Play
Misc
Help
JADS Analysis Toolbox Last Updated: June 24, 1999
User interface to the JADS analysis software.
Entity-state PDU parameters
Non-entity-state PDU parameters
PDU counts summary
Time parameters
Moving entities

4.1 Entity-State PDU Parameters



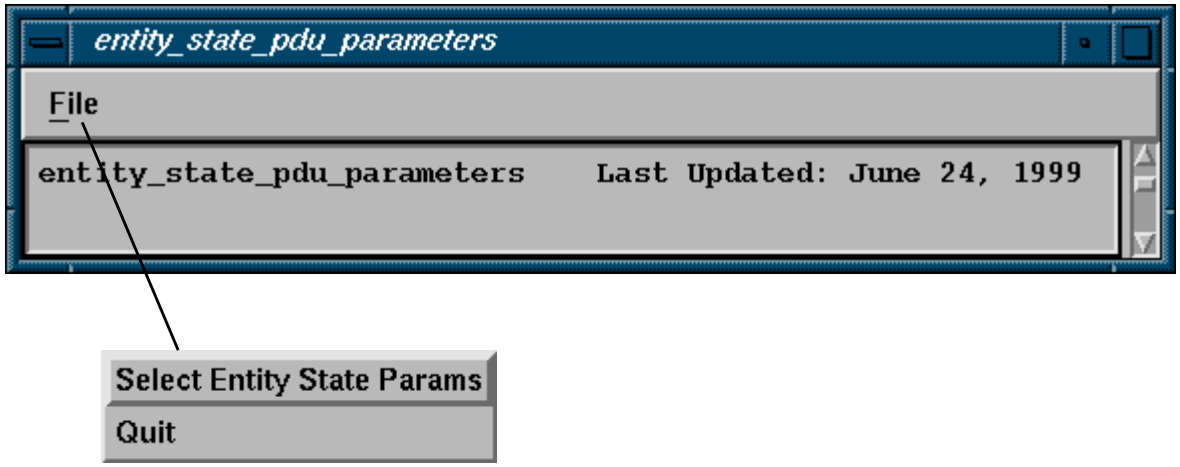
The **Extract - Entity-state PDU parameters** menu item brings up the **entity_state_pdu_parameters** routine. This routine allows users to select a JADS logfile and to print parameters from entity-state PDUs to a file in ASCII format for subsequent analyses.

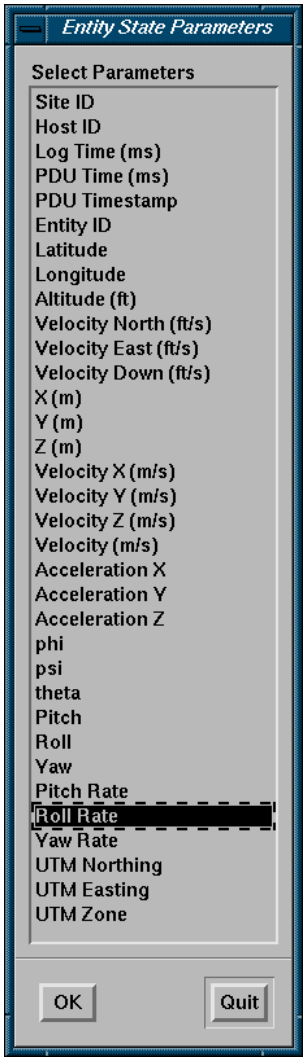
The **File** menu activates the selection of the file to print from, as well as the **Select Entity State Parame**ters dialog from which the user may select the PDU parameters to be printed.

The main window will display the location of the source logfile and resulting printed output file. PDU data are extracted from this file to an output file with the appendix '.jprm'.

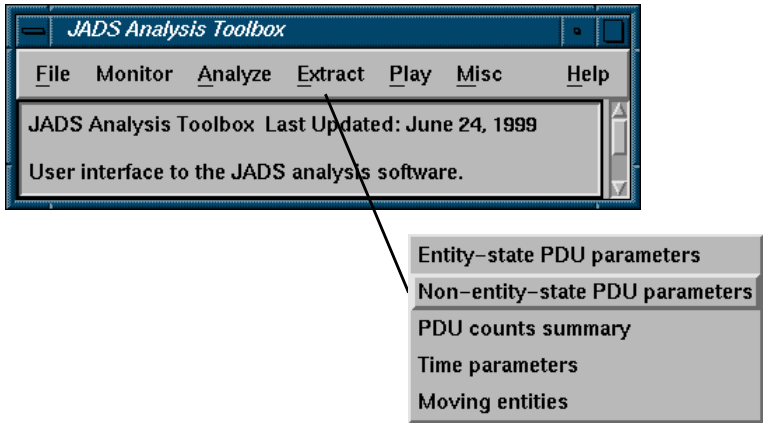
This routine is frequently used to generate text-readable output that is transported to MS-DOS® platforms and analyzed there.

4.1 Entity-State PDU Parameters





4.2 Non-Entity-State PDU Parameters



The **Extract - Non-entity-state PDU parameters** menu item brings up the **non_entity_state_pdu_parameters** main window.

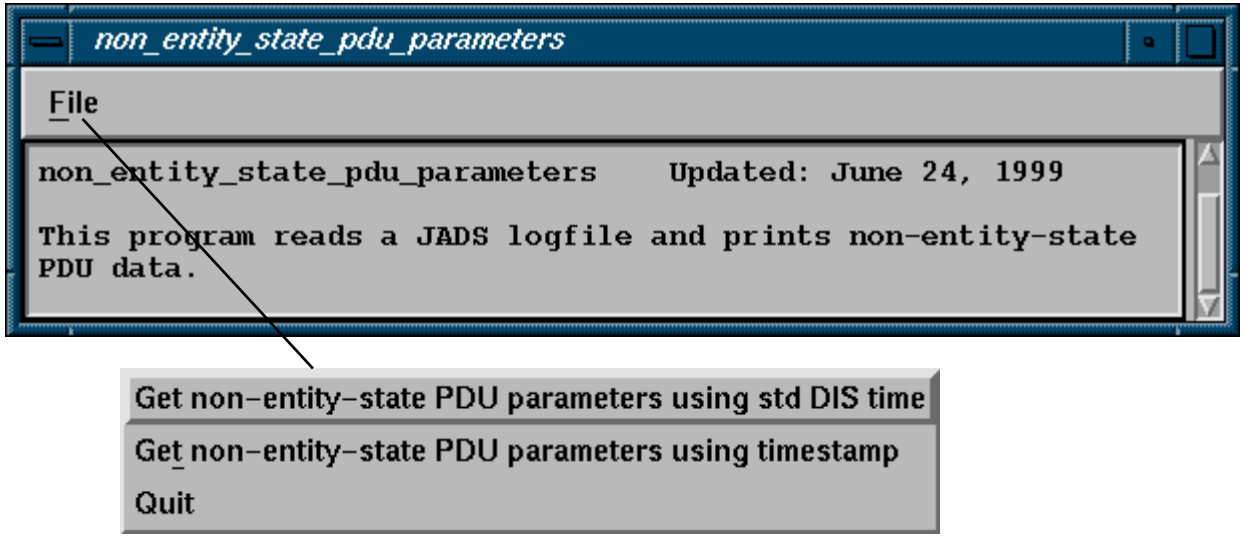
From the **File** menu, the user is prompted for a JADS logfile. Non-entity-state PDU data are dumped from this file to an output file with the appendix '.nes'.

A sample of the output is shown.

For fire PDUs, the firer entity identification, location, and range are shown.

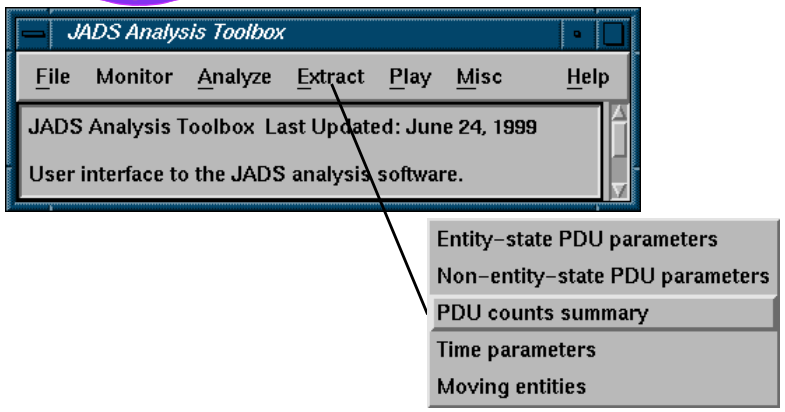
For the detonate PDUs, the firer entity identification and the result are shown.

4.2 Non-Entity-State PDU Parameters




```
Site  Host    PDU Type  Log_Time  PDU_Time
  18    43  Transmitter  62089959  62088658
  18    43         Fire  62091059  62089758 firer:018-043-030 locn:(  30.446   46.894) rng: 44445.0
  18    43  Transmitter  62093159  62091858
  18    43         Fire  62096160  62094858 firer:018-043-032 locn:(  30.444   46.897) rng: 44659.0
  18    43  Transmitter  62100660  62099358
  18    43         Fire  62101260  62099958 firer:018-043-031 locn:(  30.448   46.897) rng: 44259.0
  18    43  Transmitter  62103861  62102558
  18    43  Transmitter  62110962  62109658
  18    43   Detonation  62147768  62146458 firer:018-043-030 result: Detonation
  18    43   Detonation  62153268  62151958 firer:018-043-032 result: Detonation
  18    43   Detonation  62157669  62156358 firer:018-043-031 result: Detonation
```

4.3 PDU Counts Summary



The **Extract - PDU counts summary** menu item brings up the **Count PDUs** main window.

From the **File** menu, the user is prompted for a JADS logfile to be analyzed for PDUs.

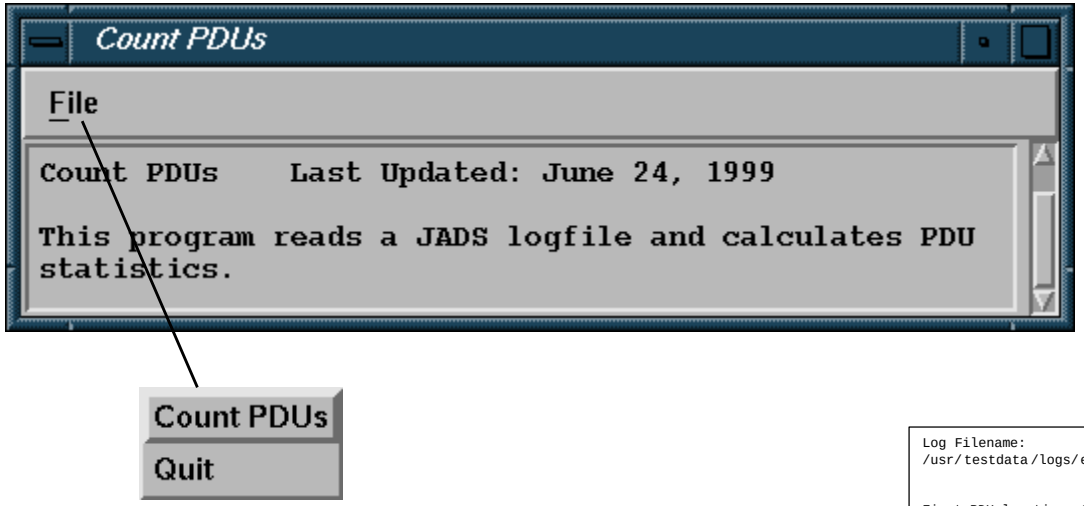
The main window shows the source and output file locations. The output file has the appendix '.jstats'.

A sample of a *.jstats file is shown.

The output contains

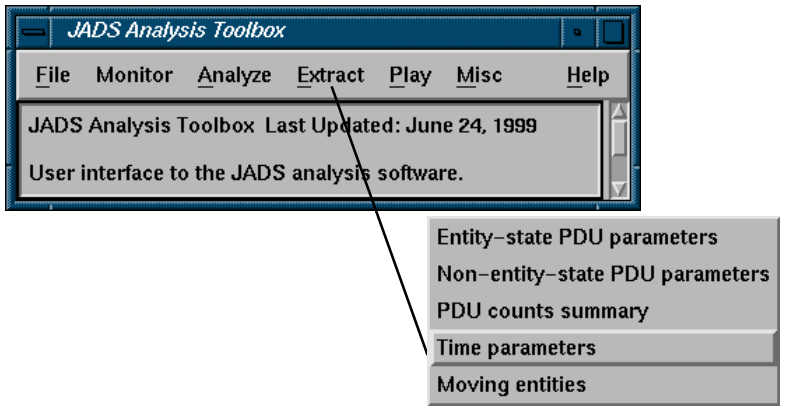
the first and last PDU log times
the number of PDUs received by PDU type for each site host
the number of PDUs received by site host for each entity number

4.3 PDU Counts Summary




```
Log Filename:
/usr/testdata/logs/ete/091698/091698_test90301_ftsill.log


First PDU log time: 09/16/1998 13:58:40.579 msecs: 50320579
 Last PDU log time: 09/16/1998 19:01:32.961 msecs: 68492961


NUMBER OF  PDUS RECEIVED FOR EACH SITE-HOST

  Site-Host  Ent_State   Xmitter    Signal     TOTAL
00018-00043       314       112        20       446
00018-00041         0        39        20        59
      TOTAL       314       151        40       505


NUMBER OF ENTITY-STATE  PDUS RECEIVED FOR EACH SITE_HOST
ENTITY

Site-Host    Entity_ID  Number_Rcvd
00018-00043          2           11
00018-00043          3           11
00018-00043          4           11
00018-00043          5           11
00018-00043          6           10
00018-00043          7           10
00018-00043          8           10
00018-00043          9           10
00018-00043         10           10
00018-00043         11           1
```

4.4 Time Parameters

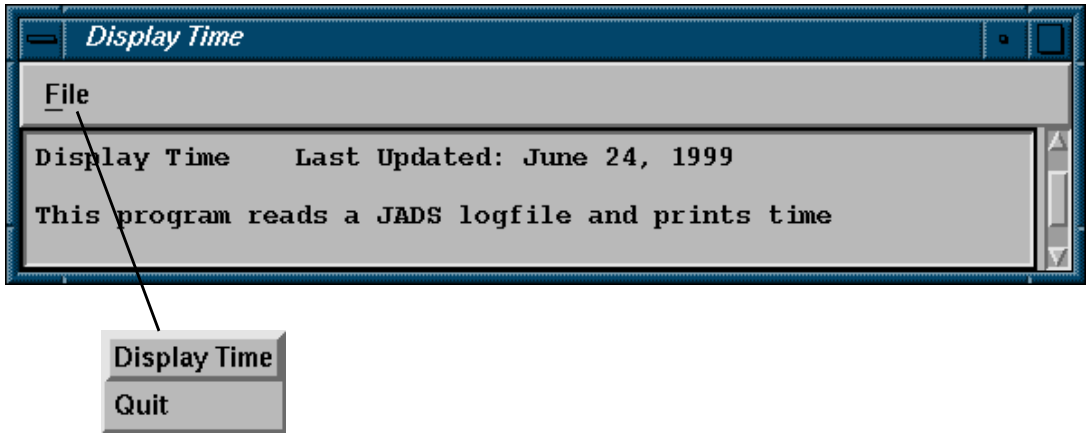


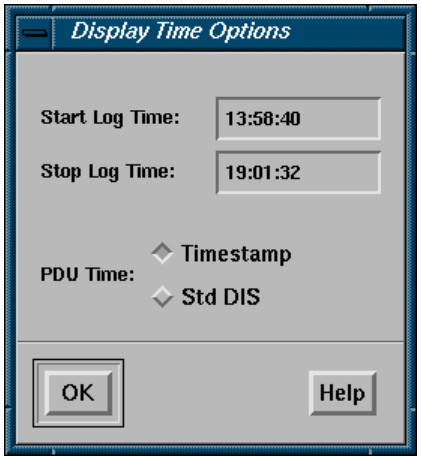
The **Extract - Time parameters** menu item brings up the **Display Time** main window. From the **File** menu, the user is prompted for a JADS logfile which is to be analyzed for time parameters.

After file selection, the user is prompted for start and stop log times (the area of interest) and whether DIS standard time or Timestamp (game time) is to be displayed for the PDU time. The input and output file locations are shown in the main window after completion. A sample output file is shown. The times displayed include

the log time seconds (value of the first UNIX™ system word for time)
the log time microseconds (value of the second UNIX™ system word for time)
the log time milliseconds
the log time "time of day," i.e., hh:mm:ss.sss
the PDU timestamp value (the full 32 bits if game time is used, else the first 31 bits)
the PDU milliseconds (after the appropriate first log time hour is added and hour rollovers are added as appropriate)

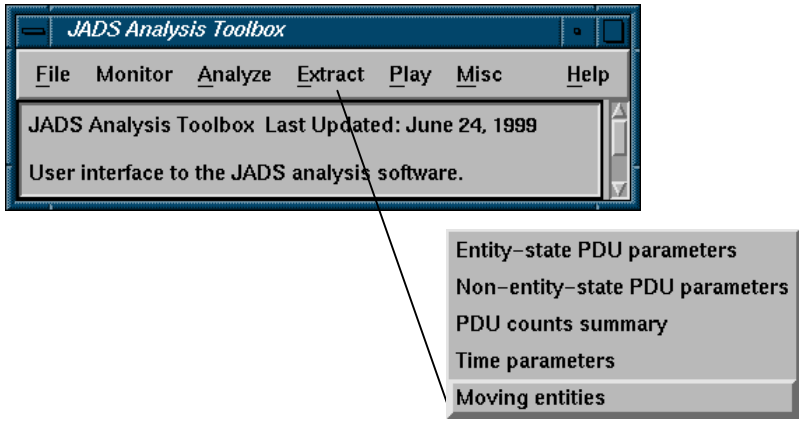
4.4 Time Parameters





PDU	PDU_Type	Entity_ID	Log_Secs	Log_usec	Log_msec	Time_of_Day	PDU_TStamp	PDU_msec
1	Entity_State	2	905954320	579365	50320579	13:58:40.579	4197865214	50318609
2	Transmitter	0	905954334	313490	50334313	13:58:54.313	4214481312	50332537
3	Signal	0	905954334	327276	50334327	13:58:54.327	4214481312	50332537
4	Transmitter	0	905954336	479263	50336479	13:58:56.479	4225768932	50341998
5	Signal	0	905954336	634720	50336635	13:58:56.635	4225768932	50341998
6	Transmitter	0	905954336	857609	50336858	13:58:56.858	4217583186	50335137
7	Transmitter	0	905954337	134039	50337134	13:58:57.134	4225768932	50341998

4.5 Moving Entities

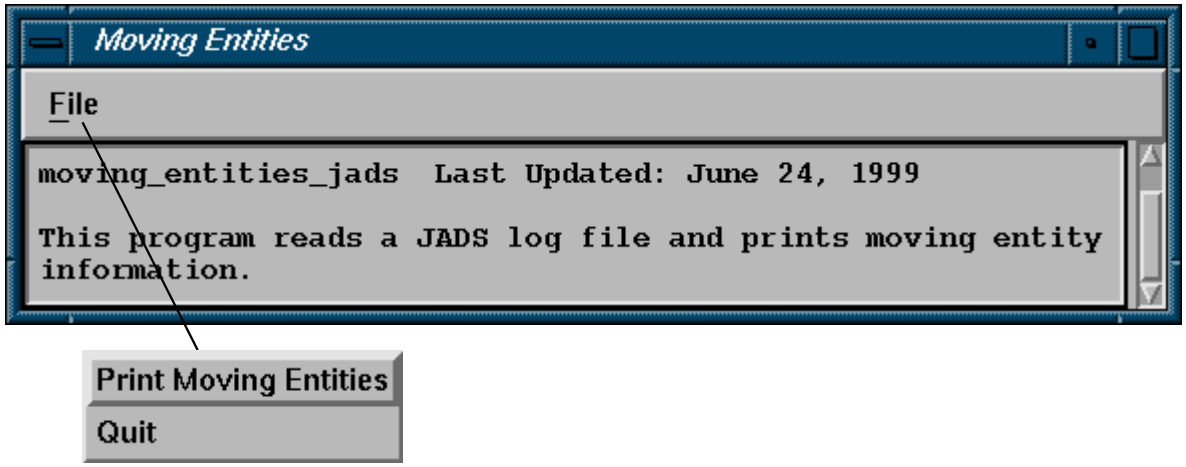


The **Extract - Moving entities** menu item brings up the **Moving Entities** main window. From the **File** menu, the user is prompted for a JADS logfile which is to be analyzed for PDUs.

The locations of the input and output files are shown in the main window after the analysis is completed. For each minute of log time, the output shows

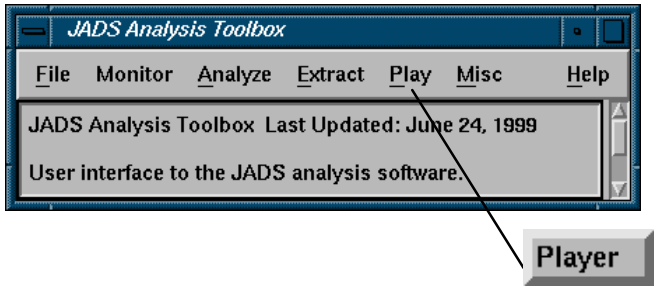
- the log start and game start time
- the number of PDUs received (during this minute)
- the number of entities that started moving (during this minute)
- the number of entities that stopped moving (during this minute)
- then, for each site:
  - the site number
  - the number of entities from that site that started moving (during this minute)
  - the number of entities from that site that stopped moving (during this minute)
  - the total number of entities moving from that site

4.5 Moving Entities



log_start	game_start	PDU_count	to_str_mov	to_stp_mov	site	str_mov	stp_mov	tot_mov	site	str_mov	stp_mov	tot_mov
53746578	3989949982	2	0	0	23	0	0	0	18	0	0	0
53862695	4128462646	221	219	0	23	219	0	219	18	0	0	0
53932851	3658640	3	2	0	23	2	0	221	18	0	0	0
53993137	3700962	46	43	0	23	43	0	264	18	0	0	0
54053814	3779610	2	0	0	23	0	0	264	18	0	0	0
54153036	179836718	28	26	0	23	26	0	290	18	0	0	0
54222442	3925908	135	134	0	23	134	0	424	18	0	0	0
54325261	387665430	449	413	0	23	413	0	837	18	0	0	0
54386822	4112862	536	508	0	23	508	0	1345	18	0	0	0
54446845	4172848	124	1	2	23	1	2	1344	18	0	0	0
54554930	4280822	62	1	17	23	1	17	1328	18	0	0	0
75202767	21786230	44	0	8	23	0	8	441	18	0	0	0

5. Play



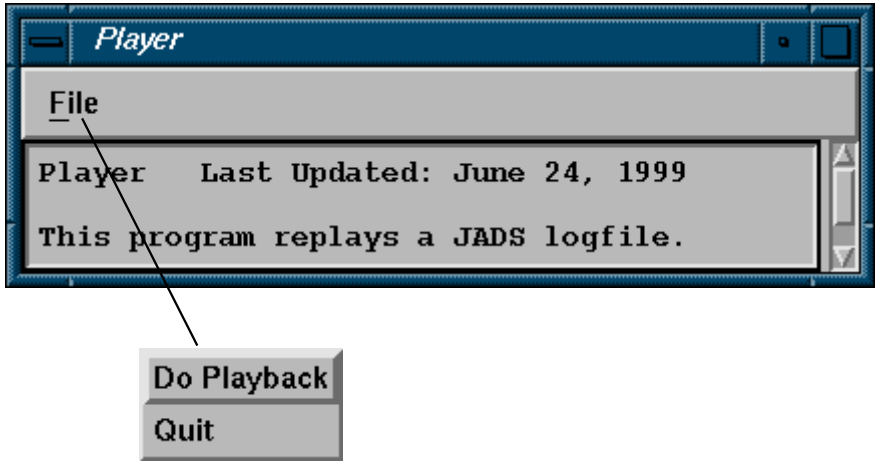
The **Play - Player** menu item allows the user to play back PDUs from a JADS logfile.

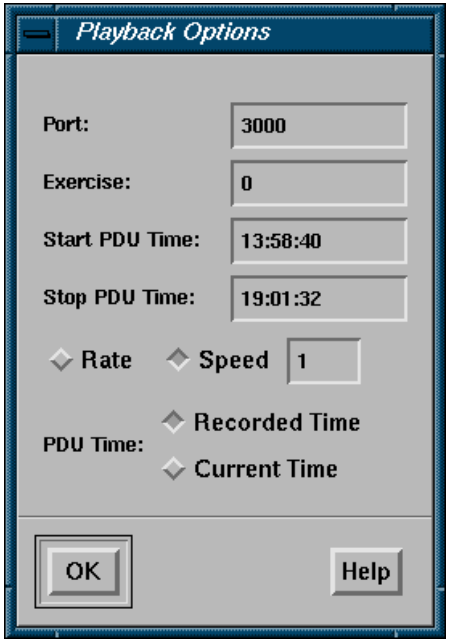
The user is prompted for the following in the **Playback Options** dialog:

the port to use for issuing PDUs
the exercise identification to use in the issued PDUs
the PDU start time and stop time to use to start and stop the logfile
the rate (if clicked, the rate is entered in the box as number of PDUs per second)
the speed (if clicked, a number is entered in the box as the multiplication factor for the speed at which the PDUs are replayed, i.e., if 2, the PDUs are played back at double the normal speed),
the PDU time (to be used), i.e., either use the PDU time that was recorded with the PDU or substitute the current time for the PDUs time

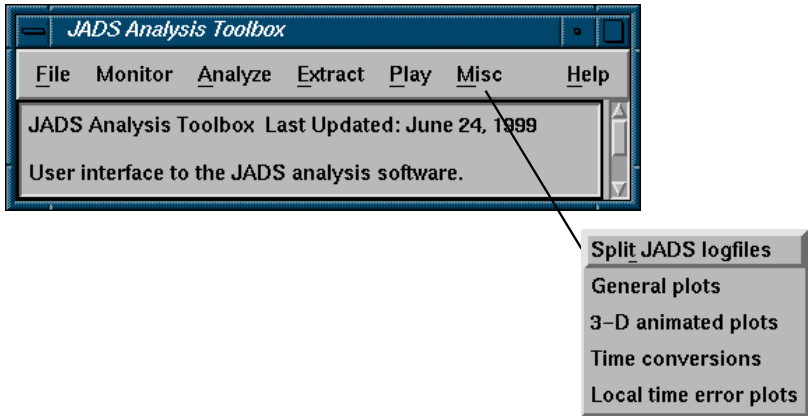
After the **Playback Options** are entered, the user is provided with a dialog to pause or quit the playback.

5. Play


Player
File
Player Last Updated: June 24, 1999
This program replays a JADS logfile.
Do Playback
Quit

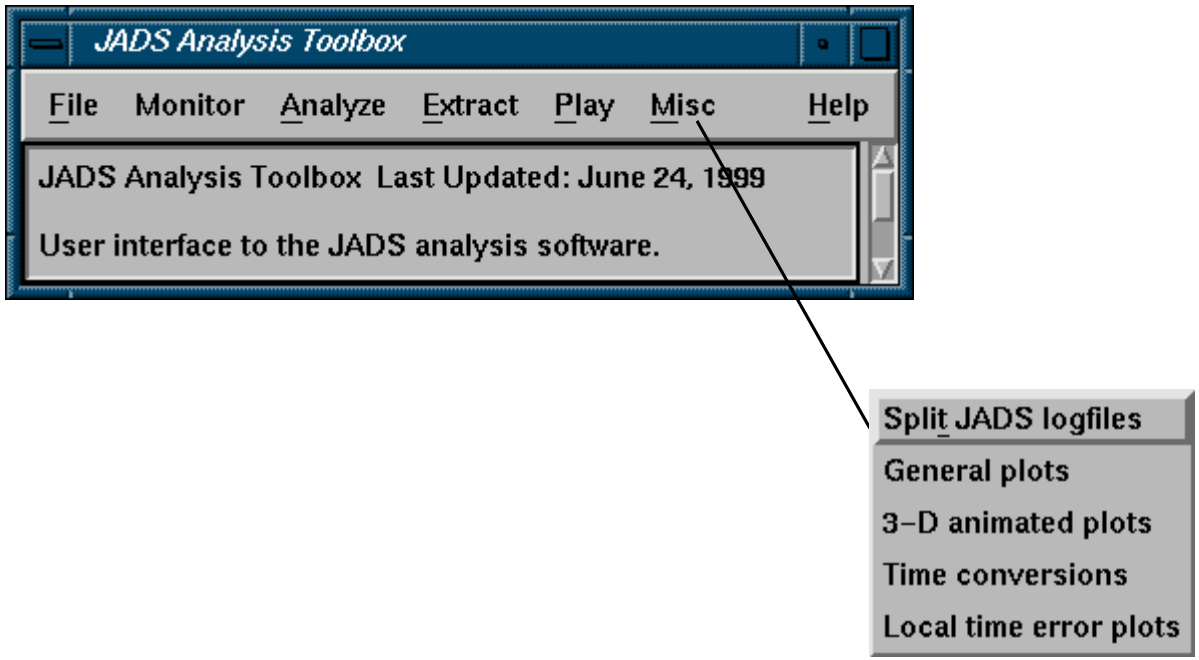

Playback Options
Port:
3000
Exercise:
0
Start PDU Time:
13:58:40
Stop PDU Time:
19:01:32
Rate
Speed
1
PDU Time:
Recorded Time
Current Time
OK
Help

6. Miscellaneous

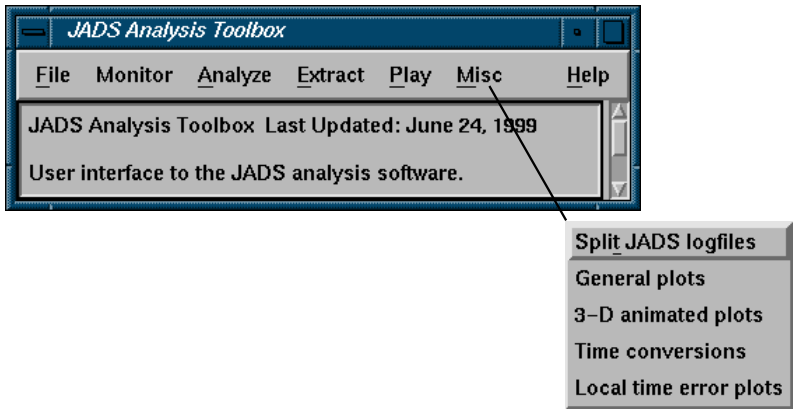


Miscellaneous routines are provided to the user in the **Misc** menu. The miscellaneous routines are presented on pages 46 - 55.

6. Miscellaneous



6.1 Split JADS Logfiles



The **Misc - Split JADS logfiles** menu item brings up the **split_file_jads** main window. From the **File** menu, the user is prompted for a JADS logfile. After selection of a logfile, the user is prompted for the log time start and end.

A new logfile is created that only contains PDUs from the selected log start to the log end time.

The new logfile has the same name as the source logfile, but the hours and minutes for the log start/end times are added to the file name. The new logfile has the appendix '.log' as do all other JADS logfiles.

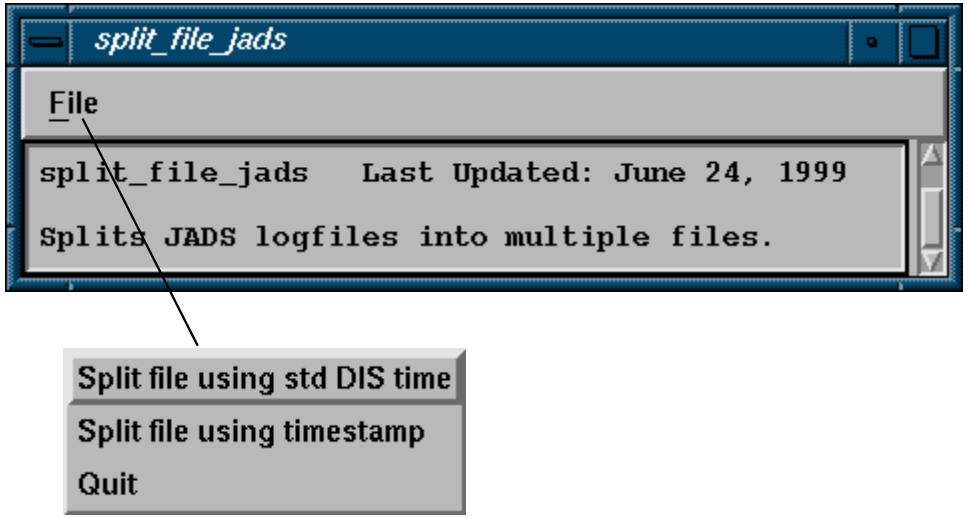
A directory listing on the next page shows that the file

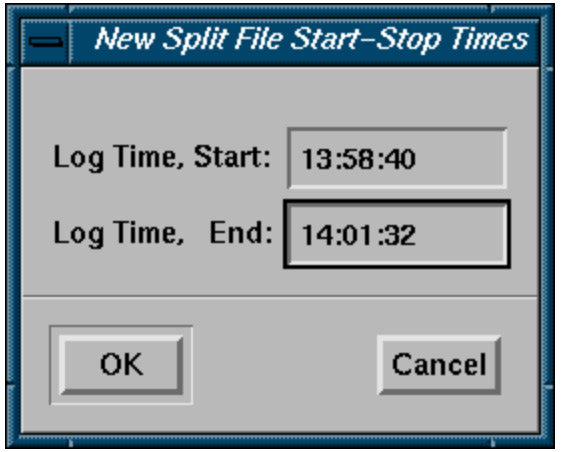
091698_test90301_ftsill.log

has been used to create another logfile that only contains data from log times 13:58 to 14:01 (hours and minutes). Its name is

091698_test90301_ftsill-1358-1401.log

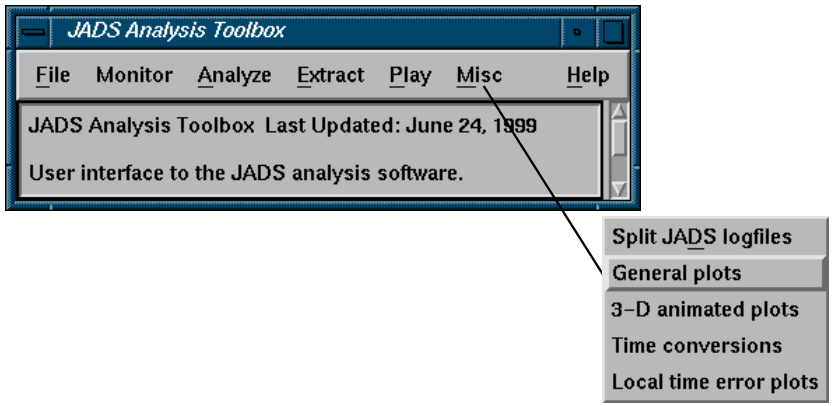
6.1 Split JADS Logfiles






```
dean@ onyx: /usr/testdata/logs/ete/091698
 % ls
091698_test90301_ftsill-1358-1401.log
091698_test90301_ftsill.log
```

6.2 General Plots



The **Misc - General plots** menu item brings up the **general_plots** routine that allows the user to plot data from any file provided the file is ASCII text/numeric data and that the number of fields in each record is the same.

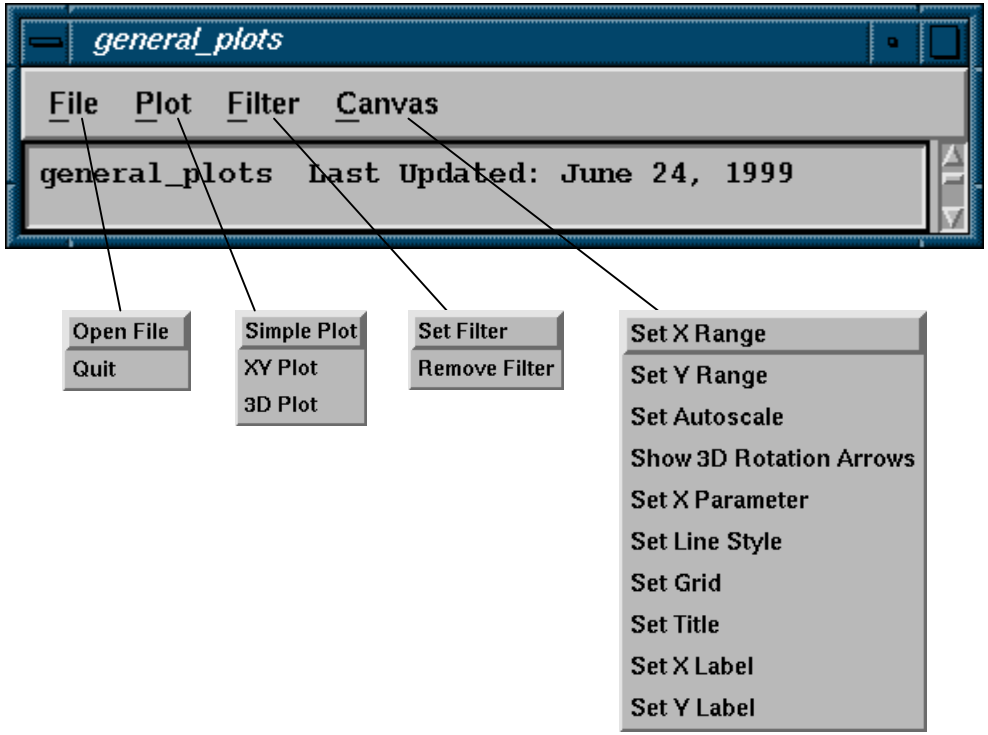
The **File** menu item allows the user to select the file to be plotted. The program checks the first line of the file to see if it contains alpha characters and, if so, uses the fields to define the field names later presented to the user for selection of fields to plot. If the first line does not contain alpha characters, the values of the fields are used to define the names of the fields.

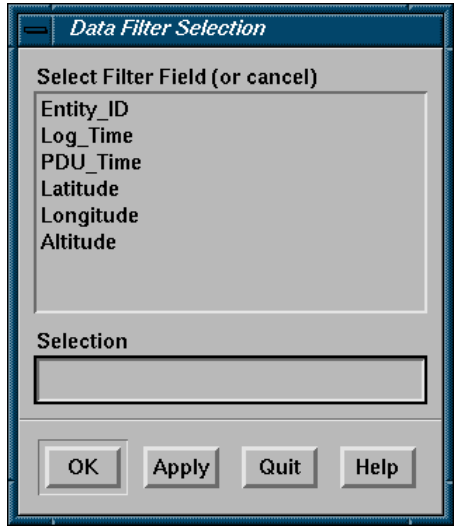
The **Plot** menu allows the user to plot a **Simple Plot** (y-values versus record number), an **XY Plot**, or a **3D** (XYZ) **Plot**.

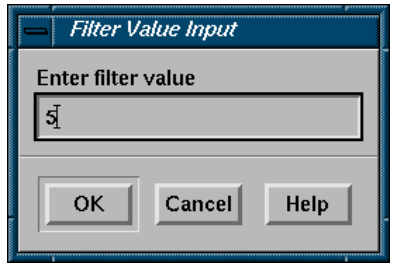
The **Filter** menu allows the user to select a field and values for that field. Only those records which have the selected value in the field will be plotted. The dialogs for **Data Filter Selection** and **Filter Value Input** are shown.

After plotting, the user can use the **Canvas** menu to vary the plot scales, etc. This utility is very handy for the general plotting of data from any file.

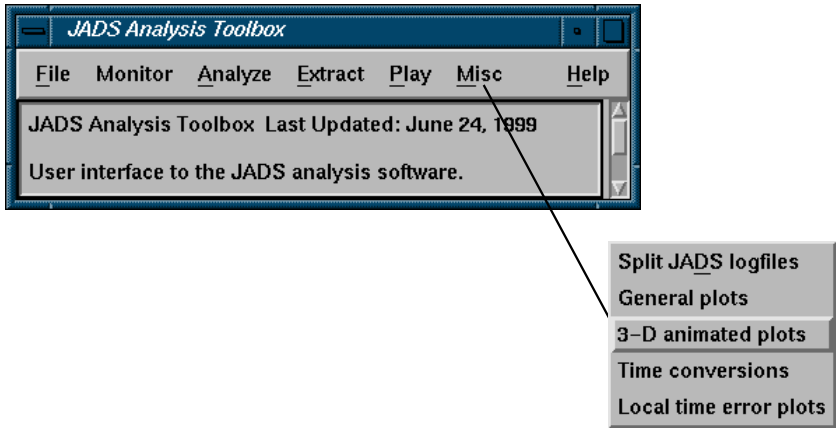
6.2 General Plots







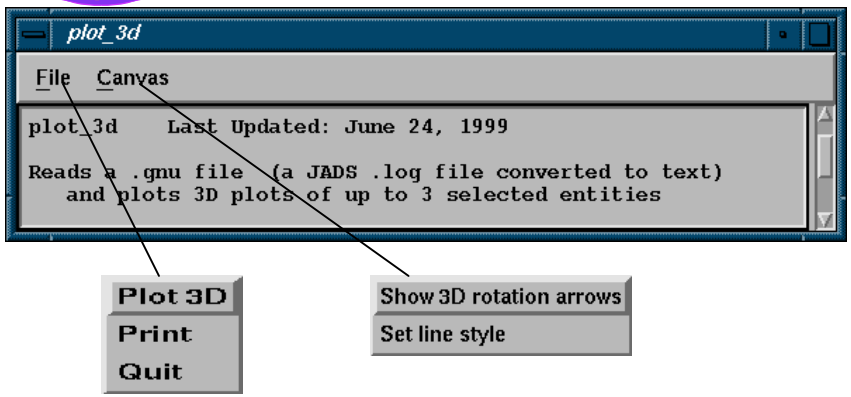
6.3 3-D Animated Plots

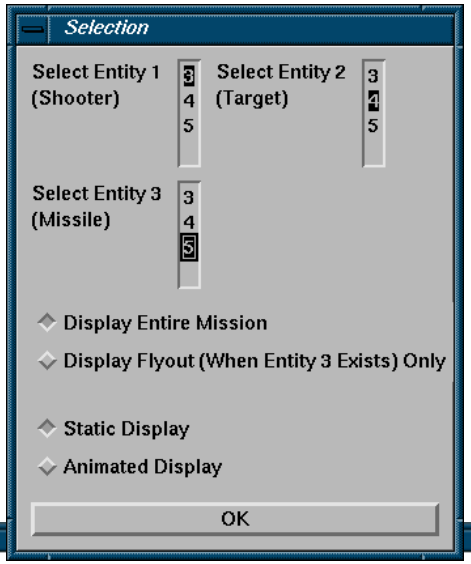


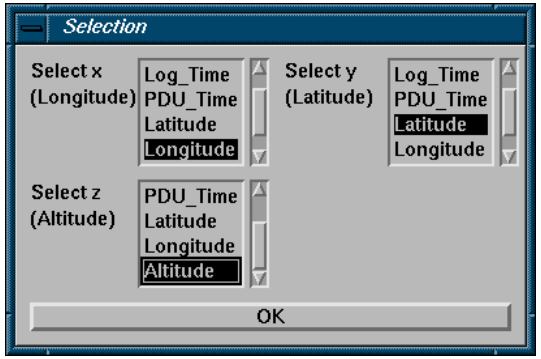
The **Misc - 3-D animated plots** menu item allows the user to obtain 3-D plots in either static or animated (time-sequenced plotting) form.

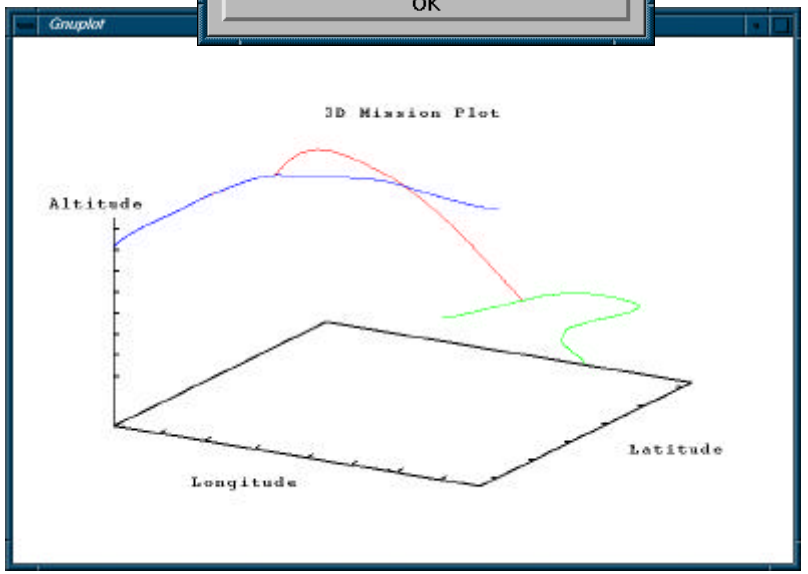
Data may be from any text file that contains columns with data that represent x, y, and z values. For animated plots, PDU time must be available as the 3rd column (as it is in .gnu files).

6.3 3-D Animated Plots

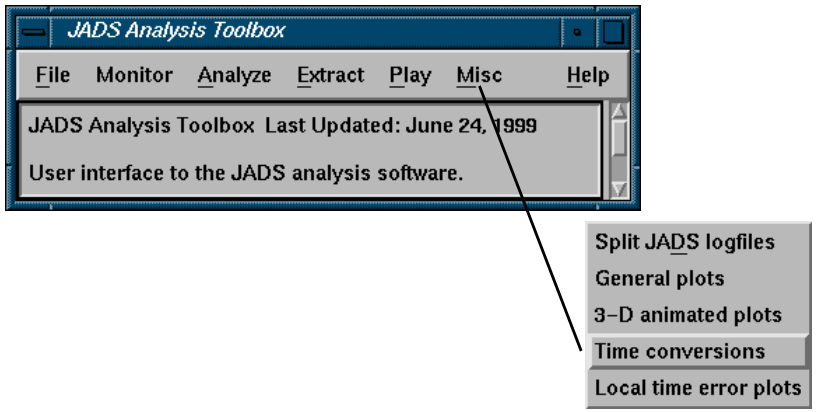








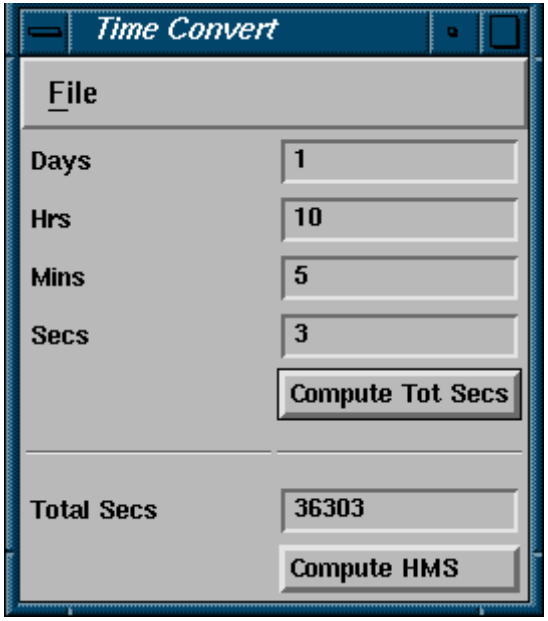
6.3 Time Conversions



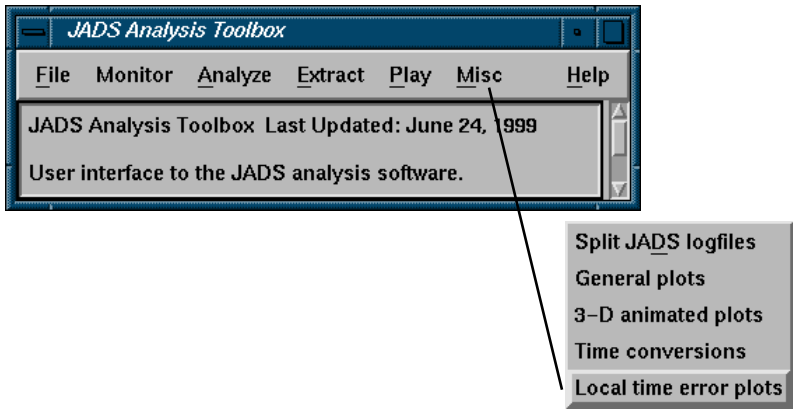
The **Misc - Time conversions** menu item brings up the **Time Convert** main window.

This simple dialog allows the user to calculate total seconds from days, hours, minutes, and seconds, and vice versa.

6.3 Time Conversions



6.4 Local Time Error Plots



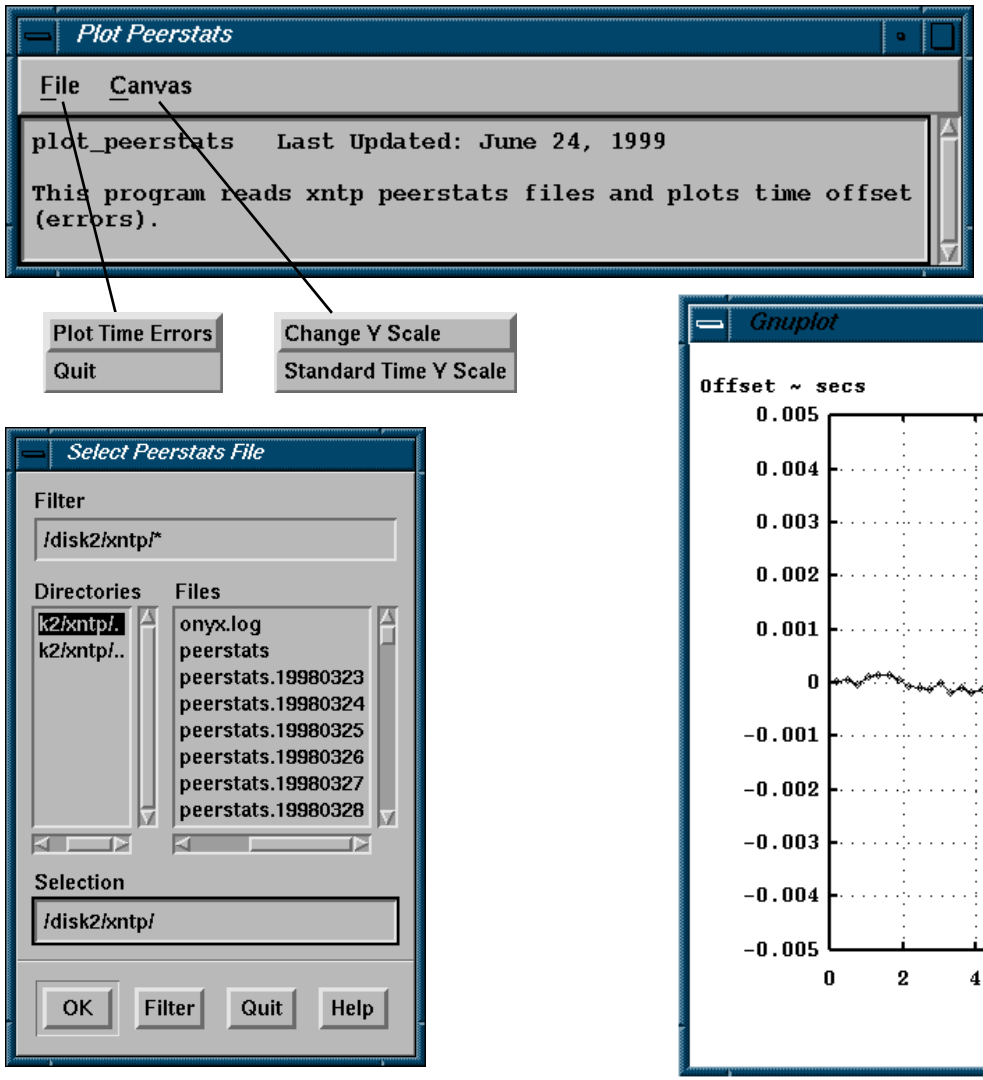
The **Misc - Local time error plots** menu item brings up the **Plot Peerstats** routine which allows the user to plot peerstats files data.

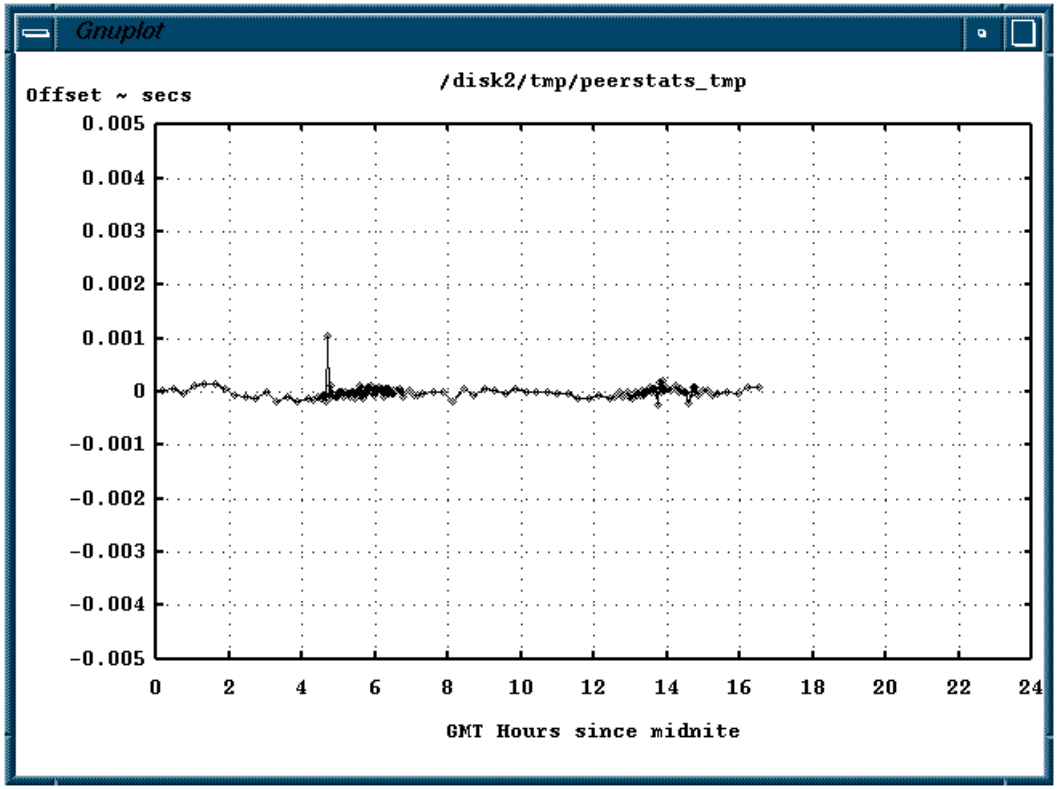
If the environment variable PEERSTATS_DIR is defined, the routine will bring up the files dialog pointed to that directory. The location of the XNTP peerstats files is specified by the user when XNTP is set up for a machine.

The user can double click on any of the files to see the peerstats time_offset data plotted with each major division being 2 hours. Zero time is zero Greenich mean time.

The plot has been set up with a **Standard Time Y Scale** that shows the JADS time error tolerance bands of + or - 1 millisecond. The user can **Change Y Scale** using the **Canvas** menu dialog shown. This will bring up another dialog into which the user can enter an upper y-scale value and a lower y-scale value, separated by a semicolon.

6.4 Local Time Error Plots





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